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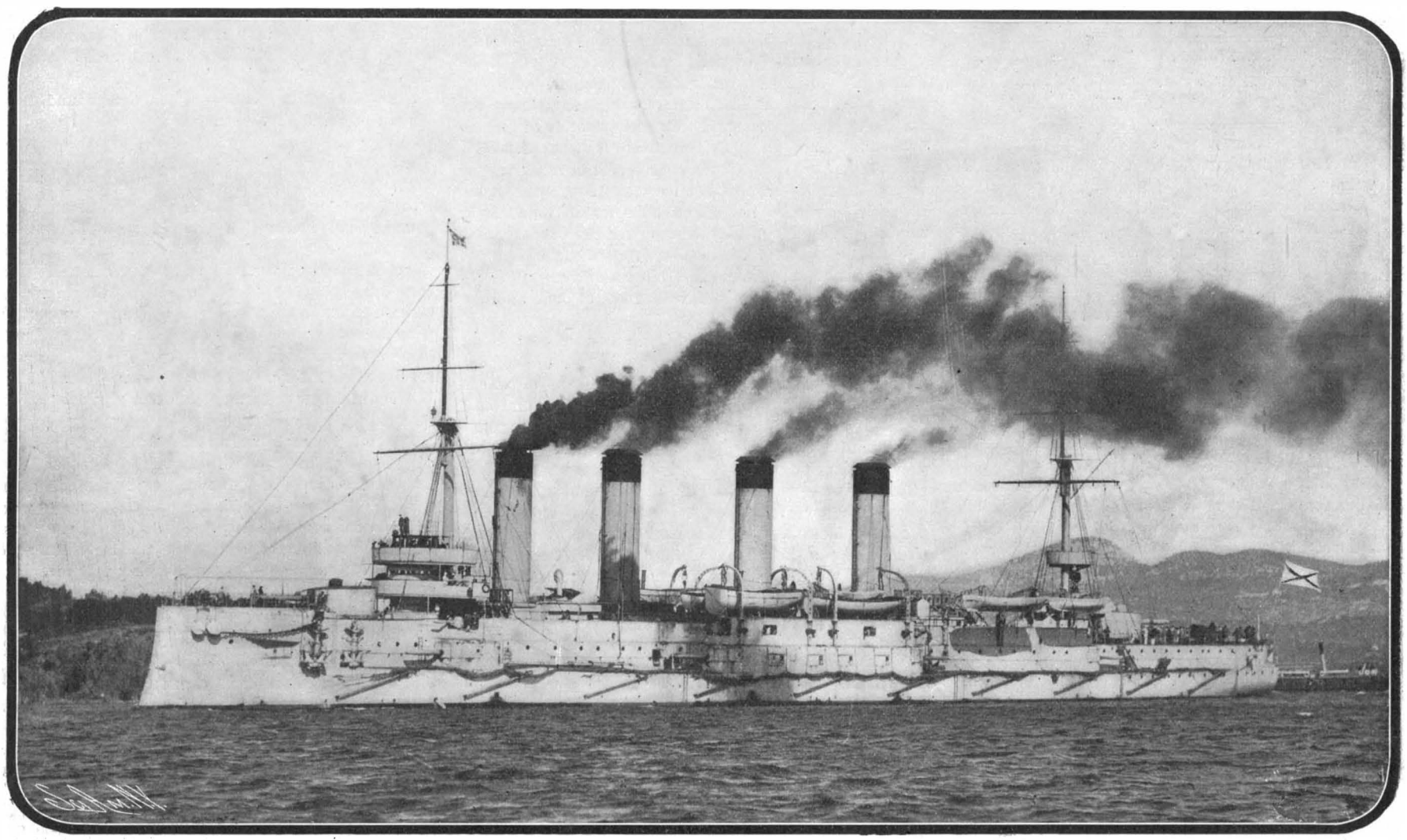
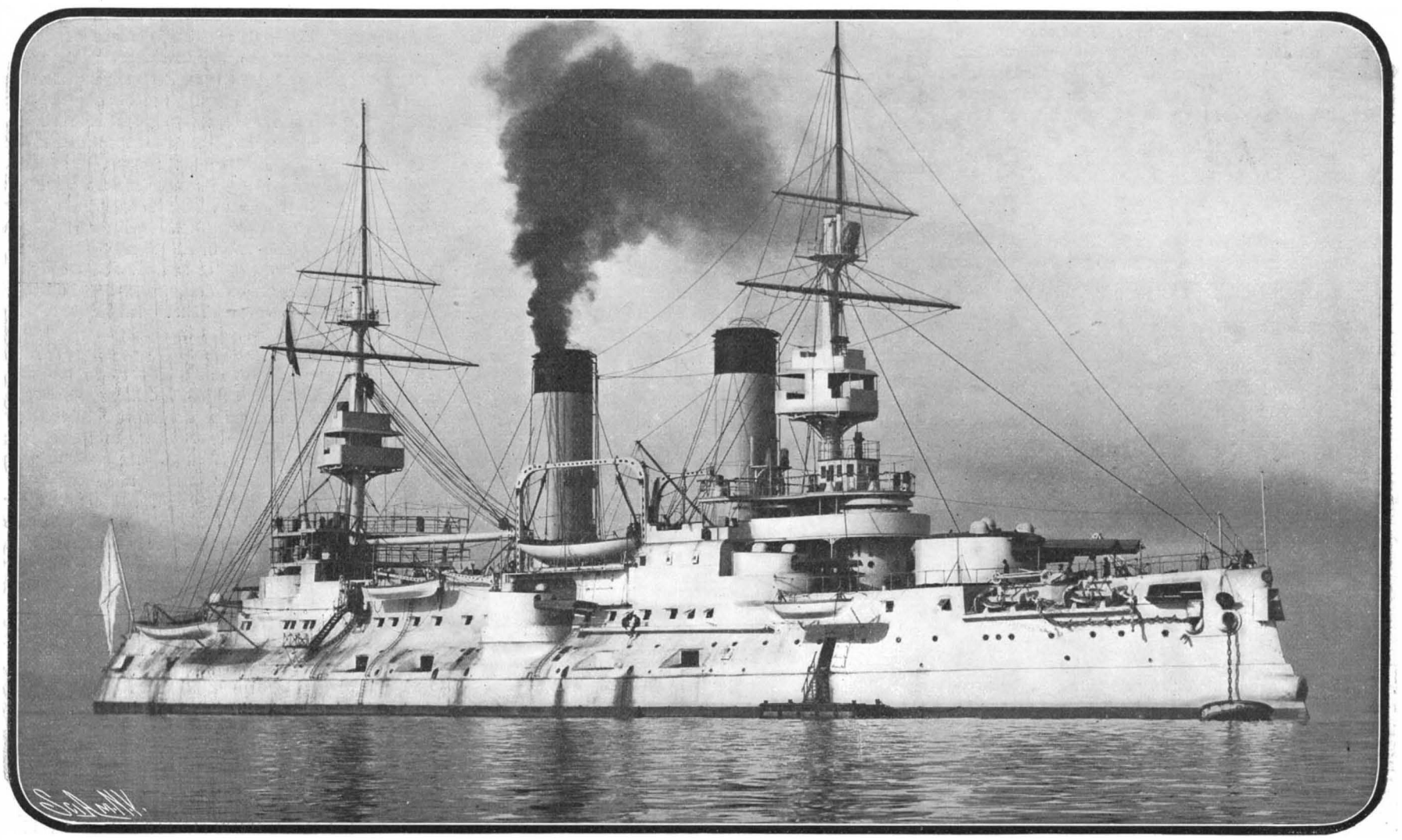


Displacement, 7,800 tons. **Speed,** 21 knots. **Coal,** 1,100 tons. **Armor** (Krupp): Belt, 8 in. to 4 in.; Deck, 2 in.; Gun positions, 7 in. to 6½ in. **Guns:** Two 8-in.; eight 6-in.; twenty 3-in.; seven smaller guns. **Torpedo tubes:** 2 submerged.

ARMORED CRUISER "BAYAN." DATE, 1900. NOW IN THE PACIFIC FLEET.



Displacement, 13,000 tons. **Speed,** 18 knots. **Coal,** 1,250 tons. **Armor** (Krupp): Complete waterline belt, 10 in. to 4½ in.; Complete belt above this, 8 ft. deep, 6 in. to 2½ in.; Protective deck, 4 in. on slopes; Gun deck, 2 in.; Main turrets, 11 in.; 6-in. gun turrets, 7 in.; Ammunition hoists, 10 in. and 5 in. **Guns:** Four 12.4-in.; Twelve 6-in.; Twenty 3-in.; Twenty-eight small guns. **Torpedo tubes:** 2 under and 2 above water.

THE FINEST BATTLESHIP IN THE RUSSIAN NAVY, "CZAREVITCH." BUILT 1901. SUNK AT PORT ARTHUR.—[See page 157.]

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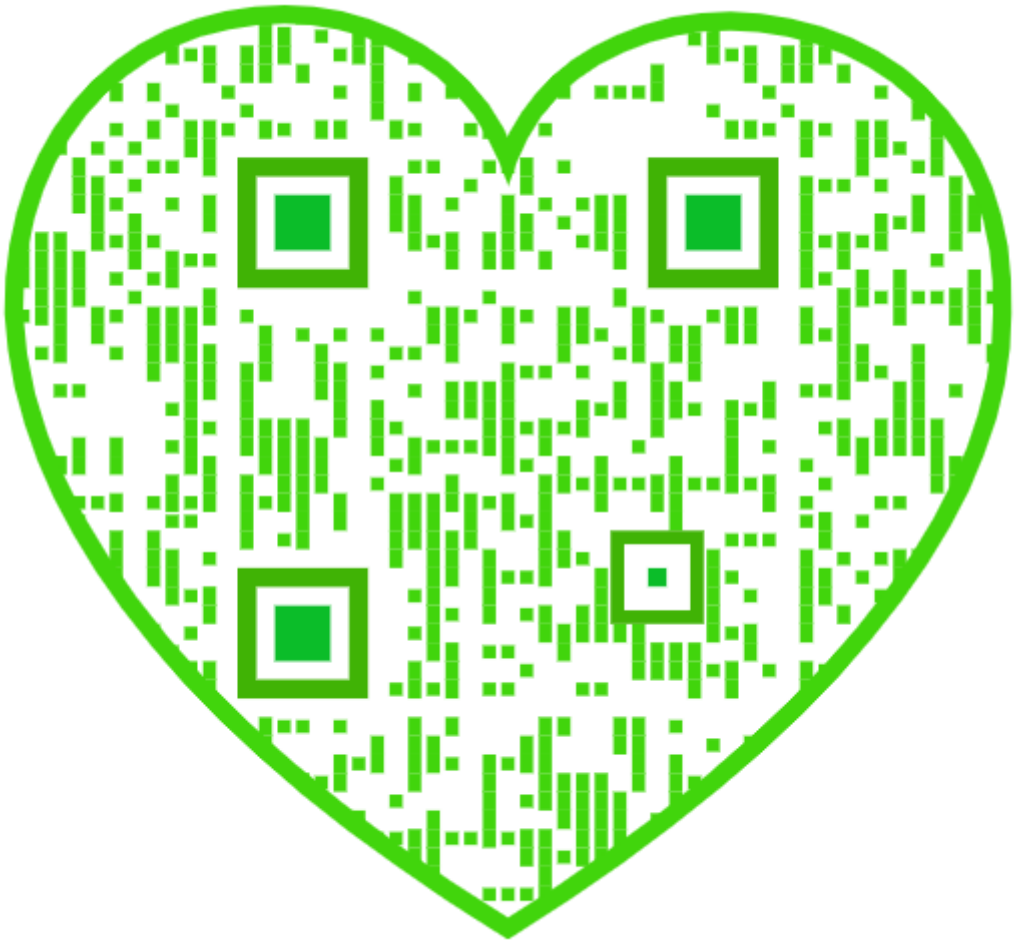

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NEW YORK, SATURDAY, FEBRUARY 20, 1904.

The Editor is always glad to receive for examination illustrated articles on subjects of timely interest. If the photographs are *sharp*, the articles *short*, and the facts *authentic*, the contributions will receive special attention. Accepted articles will be paid for at regular space rates.

THE MAN BEHIND THE GUN.

The crushing blow delivered by the Japanese at Port Arthur against the Russian fleet affords another proof of the fact that, after we have made a most careful comparison of the fleets of the two contending nations, it is impossible to say whether this one or that possesses the most efficient navy, until we know something about the quality of the officers and the crews. On paper, as we have shown in the present and the preceding issue of this journal, the Russian and Japanese fleets in the Pacific were approximately equal, the two extra battleships possessed by Russia fairly offsetting the superiority of Japan in armored and protected cruisers. At the close of our article we suggested that the question of supremacy might depend entirely upon the personnel; and in the short interval of a few days that question has been decided in a most emphatic manner. The ships attacked by the Japanese fleet in Port Arthur were among the very finest afloat, one of them, the "Czarevitch," being provided with internal bulkheads of armor plate, designed to limit the destruction of a torpedo, while at and above the waterline she carried two complete belts, one above the other, where the ordinary battleship carries only one. Moreover, in arming the Russian warships, particular attention has been paid to the repelling of torpedo-boat attack, and all of the ships carry an exceptionally numerous battery of 6 and 12-pounder rapid-fire guns. Yet, in spite of unusual offensive and defensive protection, the Russian ships apparently fell easy victims to the torpedo at the very first attack. The fault lies certainly not in the ships, and just as certainly it must lie with the officers and crew. It is evident that the Japanese, immediately upon the rupture of diplomatic relations, moved swiftly upon a well-considered plan. They knew the location of every Russian ship, and they were quick to seize the tempting opportunity offered by the assembly in the outer harbor of Port Arthur of the very flower of the Russian navy. The comparative ease with which torpedo boats secured their victims proves either that the Russians were extremely careless and neglected the most ordinary precautions, or that the effectiveness of torpedo-boat warfare has been greatly underrated.

In the first two or three days of the war the Japanese have crippled the Russian Pacific fleet by the destruction or disablement of eleven Russian warships, aggregating about 72,000 tons displacement, or over fifty per cent more than was put out of action by the United States ships in the whole Spanish war. What makes the loss so overwhelmingly disastrous for Russia is that these eleven are the very pick of her fleet. The "Czarevitch" is the latest and finest of the Russian battleships, the model upon which all her later vessels have been laid down; the "Retvizan," built by the Cramps, was considered also to be one of the best warships afloat, while the "Poltava" is a battleship of about the size and effectiveness of our own "Iowa." Next in importance are four splendid cruisers, among the very fastest in the world, the "Variag," "Pallada," "Askold," and "Diana," vessels of 6,500 tons, 23 knots speed or over, with a heavy modern armament. Then there is the cruiser "Boyarin," a crack vessel of 22½ knots speed, just out of her builders' hands, and the "Novik," of 3,000 tons, which has the distinction of being the fastest cruiser in the world, her speed being 26 knots an hour. In addition to these are the two gun-boats "Korietz" and "Mandju." Of these vessels, the sister ships "Variag" and "Pallada" are sunk, the one by gun fire, the other by torpedo, and for the present at least may be stricken off the list. The other vessels have been struck below the waterline by gun fire, and with the very limited repair facilities at Port Arthur, it will be months before they are again on the active list. The balance of naval power has passed to Japan, and her superiority appears to grow steadily as the days pass by. Having the command of the sea, she can pour the whole of her troops into Corea; for the fear of invasion being now removed, the troops that were necessary for home defense are liberated for service on the mainland. It is trivial to talk of sending out the Baltic fleet, for the ships are generally old and of doubtful value, and they would undoubtedly be intercepted and sunk by the Japanese before they reached the scene of hostilities. The Black Sea fleet is shut up by treaty obligations. With her navy crippled and blockaded, Russia must now depend upon her land forces to retrieve her reputation. Port Arthur will be cut off and besieged, and the war will probably be a repetition on a large scale of the siege and relief of Ladysmith, South Africa. The ultimate issue will in this case, as in that, depend upon the staying power of the besieging and relieving forces.

WINTER INSECTS.

The first chill days of autumn send a thrill all through the barren woods and fields. Foliage begins that magic change of color which glorifies the landscape of our American autumns; tender, sensitive plants of garden and fields shrink and shrivel up before the chilling blast, and tens of thousands of insects cease their hum and grow sluggish and voiceless. Wild animals and reptiles lift up their heads in mute appeal to the lingering rays of a still warm sun, but retreat to their homes in holes and burrows as night falls around. A mystic silence creeps over the country, and a period of rest for all nature follows. It is harvest time for man, and he garners his grain and fruits, replenishing his storehouses with food to last another season.

It is the final end for great multitudes of insects, which live but a summer, and then pass into the eternal silence of death. To them the few months of warm weather have been a lifetime—the beginning and end of all existence. The days and weeks have been years and decades to them—the completion of the cycle of youth, maturity, and old age. They have lived their allotted time—performed their work—and died. But they have perpetuated their species in the eggs and cocoons which they have securely buried in plants and trees, where neither frost nor ice can injure them. They may yield up their individual life; but their race continues forever.

For others the end of summer merely portends the beginning of that strange period of rest which we term hibernation. Life's activities and functions are merely suspended. Sleep—long, deep, dreamless sleep—broods over the earth, and beneath the crackling frost and ice, beneath the shroud of white snow and frozen earth, the dumb creatures of the woods and fields are slumbering. Occasionally a warm day of mid-winter penetrates to their hidden homes, and they move restlessly.

If the naturalist knows the secrets of nature, it is not difficult to find studies of animal and insect life in the woods and fields these cold days. Every tree and plant is the home of some creature, and beneath every sod and trunk there is reposing some hibernating insect or four-footed beast. Nature's signs are invisible to the uninitiated, but to those who know, they are scattered around plentifully, suggesting experiences that will amply justify the inconvenience of a day's trip to the woods. But one can find all the signs of a teeming population without stirring beyond the orchard of the country home or park of the city. Tens of thousands of hibernating creatures and embryonic insects are comfortably passing their winter in the trees and plants which adorn our city parks. An acre of trees may contain a population greater than that of all the registered voters of New York or Boston.

Eggs there are everywhere—eggs which have been so carefully deposited and hidden that the severest storms and cold waves of winter are unable to touch or injure. Those which are sensitive to frost and rain are buried at the bottom of deep holes in the trees, which were drilled with such care and labor by parent insects before the frost of autumn sounded their own doom. Tiny rolls of sawdust may mark the opening of one of these drilled holes, or a slight mound of sticky substance which the mother drew over the opening. An inch or two deep in the bark and wood of the tree the eggs snugly rest until the warmth of spring hatches them. The varnish-like substance which covers the entrance sheds the snow and rain so that no moisture can penetrate to the winter home of the future insect host.

The anxious orchardist goes forth in autumn and winter to find the eggs of the insects, and in trees and vines he uncovers their hiding place. A long wire thrust down the hole exterminates eggs or hiding grub. Experienced in his work, the hunter examines the bark of a tree, and uncovers the roots of the trunk. Somewhere the trail of some sleeping grub attracts his attention, and he cuts and digs away until the hibernating creature is found. Twigs of small trees and plants yield their full quota of insect eggs. These belong to the non-perishable order—the hardened creatures which have no fear of frost or snow. With fine disdain of the cold the clusters of eggs are merely glued to bark, stones, and twigs. They are proof against wind, storm, rain, and cold. Only man can destroy them, with his implements of destruction which never fail to reach their homes. The clusters of eggs are swept and scraped from their supports and thrown into the fire.

While cold and rain will not injure these eggs and cocoons, the alternate action of frost and a warm sun may accomplish the dreaded results. Exposed to the sun's wintry rays, the cocoons and clusters of insect eggs on twigs and bark soon become more sensitive to the elements. Life is actually started therein. Death may thus follow. But the wise mothers have provided against any such contingency, and with an instinct that is marvelous every cluster of eggs is placed on the shady side of limb or tree so that the rays of the sun can never reach them. Some are placed on the north side of buildings where they are amply protected, and a few are half buried under leaves and dried grasses. Wherever located they are protected from the direct rays of the sun so that no harm can come from premature hatching.

Many insects lay their eggs in the ground, burying them just beneath the surface of the soil where they are frozen solid until spring. The site selected for such hatching grounds is always in the shade, away from any sunny exposure. Beneath stones and boards, under leaves and mold, they breed, choosing their site with a fine knowledge of all future dangers. Close to them are comfortably curled up in small bundles hibernating bugs, beetles, and worms. Some of these have crawled far down below the frost line, where they remain impassive in their slumber at an absolutely uniform temperature, and they are not disturbed until the April sun has penetrated down to their home. Then they awaken from their winter sleep, and crawl up to sunlight and life again to pass through another cycle of their existence.

Most of the earth-worms and destructive grubs penetrate to a distance of a foot or more beneath the surface of the earth, and to reach them the soil must be plowed or thrown up with a spade. Only a little work is needed to expose scores of different varieties of bugs and worms to view, while the mere lifting of a board on the shady side of a building will reveal many others which have not crawled in the earth for protection.

FORCING PLANTS BY FIRE.

A curious phenomenon connected with the forcing of flowers under somewhat exceptional circumstances was observed not long ago by M. J. Jolly.

On the second of September last, a large fire broke out in the village of Chaussée-sur-Marne, between Châlons and Vitry-le-François, and destroyed a large part of the village. The fire, urged by the wind, spread as far as it was possible, and consumed the last houses on the side toward the country. It also attacked the neighboring trees forming part of a large pear and apple orchard, and reduced the two first rows entirely to ashes. The three following rows, protected by the first, and the distance, remained standing, although considerably damaged and badly scorched. The injury done to the sixth row was naturally not so great. A goodly number of branches, nevertheless, were scorched and unable to resist the heat, while the remainder subsequently exhibited a peculiar phenomenon, viz., a second flowering. This began at the end of September, and in October all the branches of the trees except those that had been scorched were covered with blossoms, as in the month of May, the ones most heavily laden with flowers being those that had been most exposed to the action of heat. That is not all. In another direction the fire had ceased in the vicinity of some lilac bushes, and these, as well as some plum trees, flowered anew, the lilacs in particular being covered with blossoms.

It is to be remarked that the conflagration lasted but four hours at the most, and there is therefore nothing here that resembles an ordinary forcing. All the species that blossomed are those whose buds for the following year are formed in the month of August. Now the facts gathered by M. Jolly, an eye witness, seem to show that it is possible for a momentary but strong action of heat to produce a second flowering. Does this exert a local influence, a certain desiccation of the organs of the trees? It is possible; and we have seen that a previous desiccation is necessary for forcing, just as it is, according to Géard, for the parthenogenetic development of certain eggs. At all events, the fact might and ought to serve as a starting point for experiments from which might be derived practical hints for the forcing of fruits and flowers. With early varieties, it might be possible to obtain two crops, the regular one in the spring and a supplementary one in the fall, provided strong heat were employed, although for a short time, as soon as the buds are formed. This would be more economical than the present methods, since the heat necessary for the development of the flowers and fruit would be furnished, not by coal, but by Dame Nature. Some horticulturist or amateur would do well to make the experiment.

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NEW KIND OF RAYS EMITTED FROM THE BRAIN AND NERVE CENTERS.

In continuing his researches upon the rays which are given off from living organisms, and especially the human body, M. Aug. Charpentier brings out some remarkable facts. He seems to have proved that the brain and nerve centers not only give off N-rays, but also a new form of radiation which is peculiar to them. The N-rays will pass through an aluminium screen, while the new rays will not. In a paper read before the Académie des Sciences he mentions his new researches.

The emission of the N-rays by living organisms is not confined to the human body. Different animals, such as the rabbit and frog, will produce them, and no doubt the inferior animals as well. Here, as before, it is the muscles and nerves which form the principal source, and the emission of rays is stronger as these are in a state of greater activity. The frog, in spite of its small size, is a good subject, and shows that the effect is not due to an increase of temperature. This can also be proved for warm-blooded animals by heating the phosphorescent test-screen to 40 degrees C. or more (when it becomes more luminous) and its phosphorescence increases as before when placed near the muscles, nerves or nervous centers, even in a state of rest, and the effect is still stronger when these are in a state of activity. The rays act upon all forms of phosphorescence. The N-rays from the sun were found to increase the brightness of the glow-worm. M. Charpentier finds that phosphorescent bacteria have their brilliancy increased when placed near the heart, muscles, and nervous centers, in about the same way as sulphide of calcium.

Seeing that solids under pressure generally emit the N-rays, the latter were sought for in the tendons during the muscular contraction, but no effect was found. On the contrary, the bony portions which were compressed by the tendons showed a decided action. The tendons have but few nerves, while the preceding points are abundantly supplied with nerve terminals, whose compression explains the effect. It is observed that even a slight compression of a nerve considerably increases its power of augmenting the brightness of the screen, but after a time the effect dies away. It is found that it is the nerve centers of the body which have the strongest action in emitting the N-rays. The path of the spinal cord can be traced by the proof-screen. At the upper part the effect is stronger. When the arms are contracted, a corresponding increase is seen in this part of the spinal cord, and if only one arm is contracted the effect is noticed on one side alone, due to the increased activity of this part.

To explore the rays, M. Charpentier uses straight tubes of lead, from 2 to 4 inches long, one end being placed against the body and the other containing a small disk of cork or cardboard covered with the phosphorescent sulphide. Large screens cannot be used, as each part is influenced by the others and the whole gives a uniform brightness when the rays fall upon it.* One of the most interesting experiments is made upon the brain, by localizing the different centers of its surface. For instance, the so-called *psycho-motor* zones of the brain surface should, according to these experiments, show a local emission of N-rays during their special activity. This was found true for some of the best-defined zones. Among the latter is the zone which was found by Broca to be the center for articulate speech. Its projection upon the skull has been determined with a certain precision by recognized rules. M. Charpentier found that when the subject spoke with a loud voice, or even in less degree, the proof-screen showed a greater activity in this region. He has reason to believe that even the action of thought, attention, and other mental effort gives rise to an increased emission of the N-rays from the brain, and is now making observations on this point. The same effect was found in the case of other centers allotted to the act of writing, movements of the upper members, etc. The conclusion is that a nervous center increases its emission of N-rays when in a state of activity. These rays are transmitted by divergence according to optical laws. They are refracted more or less by different media and are manifested by an increase of brightness in the proof-screen, which is variable according to the intensity of the emission and the distance.

In a second note, M. Charpentier brings out the interesting point that the rays given out by living organisms differ from the N-rays discovered by M. Blondlot in certain points, and he thinks they are formed of N-rays and another new form of radiation. This is especially true of the rays from the nerve centers or nerves, whose striking characteristic is that they are partially cut off by an aluminium screen. A sheet 1-50th of an inch is sufficient to cut down considerably the rays emitted by a point of the brain. The portion of the rays which passes through the screen is no longer cut off by new screens of the same metal, even an inch thick. This latter part therefore consists of N-rays proper. On the contrary, the rays from the heart, diaphragm, and different muscles are scarcely modified by the aluminium screen. This forms a characteristic distinction between the muscular and the nerve radiations. Other differences also separate the two. The effect from the nerves is strongly increased by compression; that of the muscles is much less so. A third characteristic of the nerve radiation is that it gives a much stronger effect over the other tissues upon a phosphorescent screen which has been heated to 40 or 45 deg. C. These facts show the predominant and special role of the radiation coming from the nerve tissues. It is the nerve radiation which shows the greatest differences from the recognized N-rays.

*It may be of interest to give some practical indications as to the method of observing these radiations. A quantity of sulphide of calcium (phosphorescent) is spread upon a piece of black cardboard and fixed by collodion so as to form a thin layer; the spot should be at least 0.8 inch in diameter. It is then solarized moderately. The screen is observed in a dim light, darkening the room according to the brightness of the surface. The screen should be observed by indirect vision without looking at it too strongly. It must be remembered that the variations of brightness are produced gradually, with an inertia which depends upon the thickness of the sulphide; it is therefore of advantage to diminish the thickness of the layer. The proper precautions should be taken for eliminating outside effects.

EXTENSIVE SUBMARINE CONSTRUCTION PROGRAMME FOR GREAT BRITAIN.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

Among the maritime nations of Europe there is a feverish anxiety to equip the respective navies with a large force of submarine vessels. When this naval fighting unit was at first conceived, it was regarded with skepticism by many of the powers, notably Great Britain, Germany, and Russia. But its rapid development in both France and this country, wherein the efficiency of the craft was demonstrated, has been such that there is a strong disposition among the more conservative nations to make up leeway, so as to reduce to a considerable extent the heavy lead that has been gained by France. Great Britain was the first to follow the lead of the two countries named. It did not try to design a new type of submarine vessel, but availed itself of the Holland boat, which had at that time even become a pronounced success.

This vessel was utilized as a basis of operations, and when one or two boats of this type had been built, native inventors and naval designers set to work to incorporate their own improvements and developments. Many such contrivances and devices have thus been secured, but in the main the vessels are Holland boats.

The English Admiralty has been conducting several severe experiments with the submarines so far constructed and highly satisfying results have been achieved. At first the construction of the submarines was only carried out in a tentative manner, but now the Admiralty has decided upon an extensive scheme.

The description of vessel decided upon is a submersible torpedo boat rather than a genuine submarine. When first devised it was intended to act merely as a weapon of defense. Now, however, its offensive capabilities are well established and the principal object is to design a vessel that can travel for a long distance on the surface at a fast speed, and capable of diving instantly below the surface when the necessity arrives.

The new vessels for the British navy are to be of 200 tons displacement. Experiments have shown, at least so far as the British Admiralty is concerned, that these vessels should have as great a radius as possible, and this result cannot be obtained with a less displacement than 200 tons. Yet this displacement is only half of what the two new vessels to be laid down by the French government are to be. Each of these boats is to displace 400 tons and will be twice as large as the "Gustave Zédé," which is the largest submarine yet constructed.

The projected submersible torpedo boats approach in displacement the older types of torpedo-boat destroyers in the British navy. Their most marked feature, however, will be their ability to dive from the surface to a submerged position in the short space of about six seconds. While submerged they will be propelled by light but powerful electric motors.

The capabilities of these new vessels may be summed up as follows: (1) Traveling on the surface, sufficient fuel being carried to run the gasoline engine 50 hours and propel the vessel 400 miles at a speed of 8 knots, and, in the larger and later type, for a greater distance; (2) Awash, the boat being almost completely out of view, but the large armored conning tower rising above the surface and serving as a lookout for the officer of the watch; (3) Entirely submerged, the vessels being of sufficient strength to permit them to sink to a depth of 100 feet if necessary.

Great Britain at the present moment has eight submarines at Portsmouth, which are serving as a training school for submarine navigation and management. Eleven other craft are almost completed and will be dispatched to Portsmouth to receive the full complement of officers and men. The exact number of submarines which it is now intended to construct is being maintained a secret at present, but it is anticipated that by the end of the present year Great Britain, owing to the more rapid means of naval construction, will be able to compare favorably numerically with France. The French navy this year will have thirty submarines in commission, while in the course of a few weeks Great Britain will possess nineteen boats of this type.

SCIENCE NOTES.

Sven Hedin has furnished additional evidence of the Chinese invention of paper. On his recent journeys he found Chinese paper that dates back to the second half of the third century after Christ. This lay buried in the sand of the Gobi desert, near the former northern shore of the Lop Nor sea, where, in the ruins of a city and in the remnants of one of the oldest houses, he discovered a goodly lot of manuscripts, many of paper, covered with Chinese script, preserved for some 1,650 years. The date is Dr. Himly's conclusion. According to Chinese sources, paper was manufactured as early as the second millennium before the Christian era. The character of the Gobi desert find makes it probable that the making of paper out of vegetable fibers was already an old art in the third Christian century.

The Bulletin des Sciences Pharm. says that the numerous assays which have been made of coffee berries, etc., have shown them to contain on the average about 1 per cent of caffeine, but the determinations recently made by Bertrand are interesting as showing the percentage in the berries of the plant when cultivated in different countries, and also the percentage in the berries of other species than *Coffea arabica*. In the former case percentages varying from 0.69 to 1.60 were found. Of species other than *C. arabica*, *C. canephora* was found to be the richest in alkaloid, the berries yielding 1.97 per cent, while those of *C. humblotiana* were remarkable by reason of their containing a bitter principle, cafamarin, but no caffeine at all. The berries of *C. mauritiana* contained only 0.07 per cent, and therefore these two species may be regarded as yielding berries practically free from caffeine. This fact is of some importance, as there is a demand for a beverage that shall have the agreeable aromatic taste of coffee, but be devoid of the stimulating effect due to the presence of caffeine.

The utilization of what formerly were considered waste products and the resurrection of materials from a used-up state to a new condition of serviceableness have in recent times been developed to such a degree of completeness that we are scarcely prepared to admit that anything is ever irrecoverably lost. In this respect we believe in the conservation of materials just as we have long been taught to believe in the law of conservation of energy. From a purely practical point of view, however, some things certainly may be so completely lost to further use that their loss may well be considered absolute, and one of these is the metal lost in the wear of railway rolling stock brasses. For the speculator in copper values, the promoter of a copper "corner," to use the broker's cant, the copper which has gone into railway brasses need have no terrors. It is not likely ever to be available again in full measure. It is dissipated so completely, in part at least, that its practical recovery is not likely to receive much serious consideration. From the best available deductions on the subject it appears that five per cent of the annual copper production of the world disappears in this way every year.—Cassier's Magazine.

Signatures are being secured by the Records of the Past Exploration Society, to a petition which they will present to Congress this winter providing for the protection of historic and prehistoric ruins of this country. Briefly stated, the petition contains the following articles: (1) That Congress pass a law prohibiting exportation of prehistoric objects from the United States; (2) that so much of all lands belonging to the United States as will assure the protection of its archæological monuments, ruins, etc., be withdrawn from settlement; (3) that all antiquities found on these lands be declared to belong to the government and the people of the United States; (4) that their removal from said lands, except on written authority of some legally constituted person or body, be prohibited; (5) that to injure or deface any of these archæological monuments, ruins, etc., or to take away any of these objects from government lands, be declared a misdemeanor, punishable by fine and imprisonment, unless done in pursuance of written authority from some legally designated person or body; and (6) that said authorities may grant such permission only to national, state, municipal, or legally incorporated museums of the United States, and that said objects be deposited in some legally designated depository, not to be removed therefrom unless in conformity to the law.

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MAGNETIC BRAKE FOR SMALL ELECTRIC MOTORS.

BY THE BELGIAN CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

When a metal disk is revolved between the two poles of a powerful magnet, there are developed on it intense currents that have the effect of interfering with the motion. The greater the velocity of the disk, the more intense are the currents and the stronger the reaction. If, therefore, such a disk be fixed upon the shaft of a motor, and be so arranged as to run between the poles of an electro-magnet, the currents that develop therein will counteract the motion of the motor; and, since the reaction increases with the velocity, the motor will meet with a greater resistance in proportion to its increase in speed. It will therefore be subjected to braking and releasing automatically, and always with the power that is proper to its velocity. Experiment has shown that, in small motors, this kind of braking is more efficacious and convenient than mechanical braking.

The Siemens & Halske establishment, of Berlin, not long ago devised two types of such a brake, which are represented in the accompanying figures. In the smaller model (Fig. 1) a horseshoe magnet is so arranged that the axis of rotation of the disk corresponds to the geometrical axis of the motor. The closing of the magnetic lines of force is effected by an arc that is connected with the magnet by a brass ring. The distance between the magnet and the arc may be modified at will.

The electro-magnet is excited by two coils which are secured thereto and the extremities of the winding of which enter two mercury cups, whence fixed connections extend to terminals. Owing to this arrangement, the mobility of the magnet is in nowise interfered with by stationary supply conductors.

The horizontal magnet frame has on one end a graduated copper tube on which is a movable weight. On the other end a threaded bolt carries a counterpoise for establishing the equilibrium.

Between the magnet and the arc already mentioned revolves a copper disk mounted on the shaft of the motor. This disk is secured to the hub by steel spokes. The heat that develops in the disk is consequently not transmitted to the shaft of the motor. The hub is secured to the shaft by means of an arrangement which makes it possible to employ the same disk for motors whose shafts have different diameters. This fastening arrangement consists of a sleeve in three parts, which, by means of a hexagonal nut, is secured to the conical hub, and, in this manner, to the shaft of the motor.

In order to limit the movement of the magnet frame and to determine the zero position, an upright carrying two stops and an indicating pointer is placed at the extremity of the copper tube or beam, which is pointed at its end as shown. The rod and the bearings for the brake are mounted on a common base plate. In the large model (Fig. 2) the electro-magnet is movable upon the beam, so as to permit of compensating for the action of terrestrial magnetism. Such an arrangement was not deemed necessary for the small model, because the influence of terrestrial magnetism is of no consequence.

The important point in mounting is that the axis of oscillation of the electro-magnet shall coincide very exactly with the prolongation of the geometrical axis of the motor. After the brake has been mounted, the movable weight is placed at the zero point of the beam and the counterpoise is regulated until the beam is directly opposite the index. After the magnet has been set in action, the beam is brought back to the zero position in consequence of the action of terrestrial magnetism. The error that results is of no consequence in the small model, and is corrected in the large one by the arrangement just described.

In Fig. 2 the counterpoise of the brake, placed in a north-south position, points north. The magnet makes an angle of about sixty-five degrees with the horizontal. Should circumstances require that the brake be mounted in the opposite direction, the magnet must be placed in such a way as to make the same angle, but on the other side, that is to say, to the right instead of to the left. For this purpose, the brake is removed from its bearing, the nut that fixes the magnet to the frame of the beam is unscrewed, the position desired is given the magnet, and the brake is replaced upon its bearing.

The boxes seen in the figures contain the special sleeves necessary for shafts of 6, 7, 8, 9, 10, and 12 millimeters in diameter for the brake of the second model, and also the various weights, counterpoises, and tools for the mounting of the apparatus.

If, after the starting of the motor, the magnets be excited, currents will be produced in the disk that will tend to cause the magnet to revolve around its axis. The beam by that very fact will leave its position of equilibrium, and, if the movable weight be displaced the equilibrium will be re-established. The work of the motor can then be calculated according to the following formula:

$$L = \frac{2\pi . b . n Q}{60.75} = \text{H. P.}$$

in which Q is the movable weight in kilogrammes, b the displacement of the latter starting from the zero point, and n the number of revolutions of the motor per minute. The value $\frac{2\pi Q}{60.75}$ is constant, and may be displaced by C. Then $L = C, n, b$. In order to simplify the calculation, the movable weight, Q, is so selected that C shall be a whole number.

The applications of these brakes have given excellent results, and it is to be anticipated that all those who employ small electric motors will find it to their advantage to make use of them. The arrangement described, in fact, serves not only for the determination of the power of a motor, but also, and especially, for the regulating of the velocity of it.

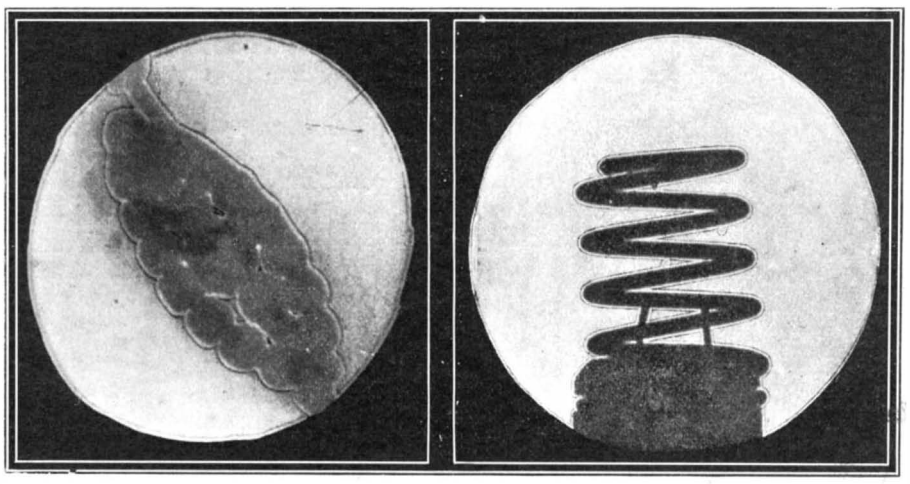

Fig. 1.—Shadow of a Brooch Cast by Sirius. Fig. 2.—Shadow of a Spring Cast by Venus.

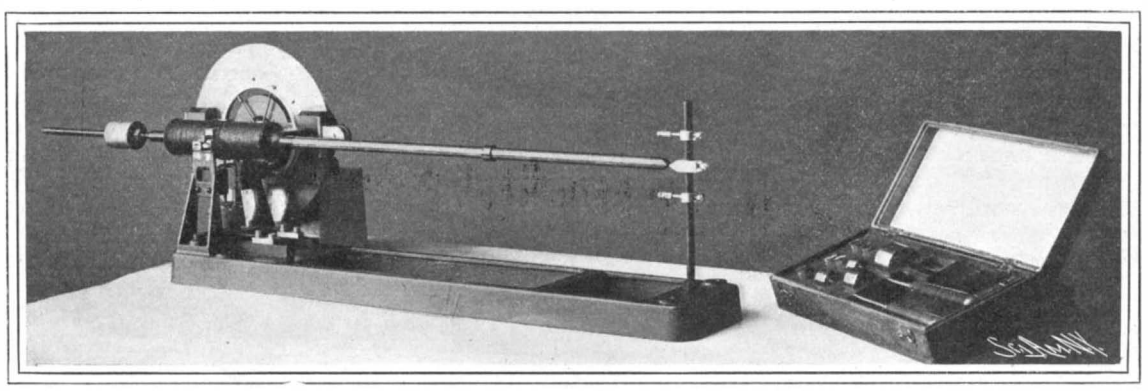

Fig. 1.—SMALL MODEL MAGNETIC BRAKE.

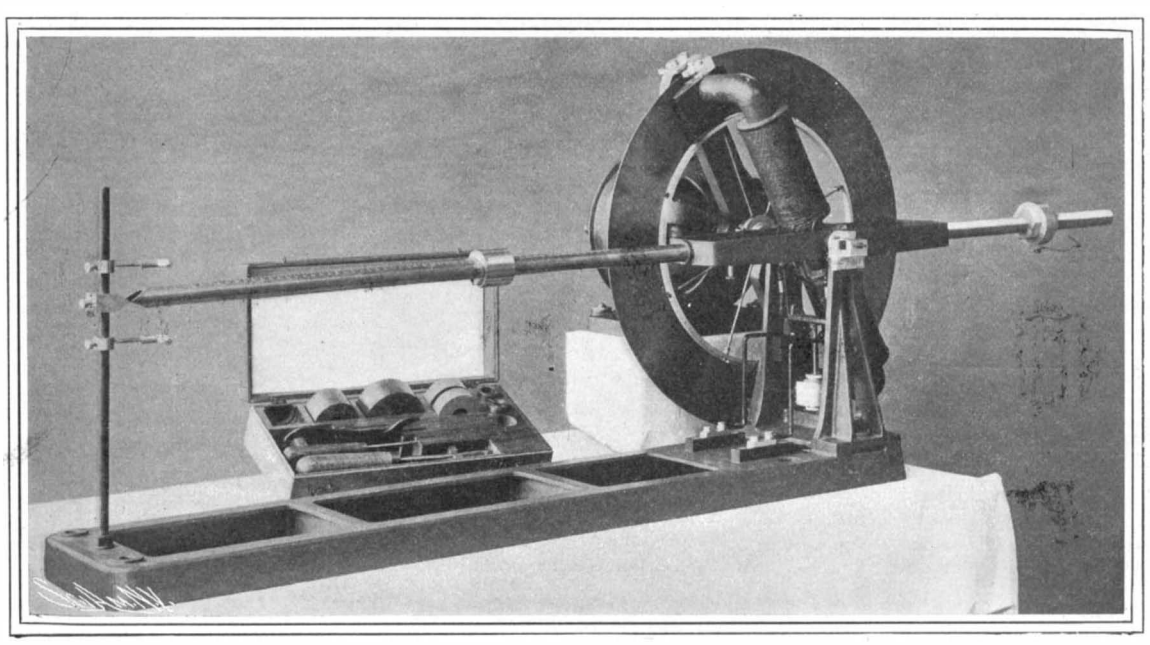

Fig. 2.—MAGNETIC BRAKE FOR SMALL MOTORS (LARGE MODEL).

PHOTOGRAPHY OF STAR SHADOWS.

BY EMILE GUARINI.

In the majority of scientific questions, the least fact is, as well known, capable of giving rise to interesting researches and offering material for important philosophical deductions.

The study of the shadow projected by the stars is a case in point. It would appear so much the less interesting, at first sight, in that we do not usually think that there are any stars except the sun or moon that project a shadow. Now, a more minute examination of the subject shows that such is not the case and that, although few stars produce a *visible* shadow, there is nevertheless a large number of which the shadow can be photographed. The very interesting researches that have just been made by M. E. Touchet, assistant secretary of the Astronomical Society of France, prove this. There is, in the first place, reason for examining the most brilliant stars and planets, and, among others, the planet Venus, the Shepherd's Star. Venus, in fact, is, with the sun, the moon, and Jupiter, the only star that projects an appreciable visible shadow, and, in astronomical treatises and reviews, we may find numerous references to observations of this phenomenon. M. Camille Flammarion, in his magnificent work entitled "The Lands of the Heavens" expresses himself upon this subject as follows: "The light of Venus is so powerful that it occasionally produces a shadow. I noticed this fact unexpectedly one evening and without having in any wise previously thought of it. Returning from a trip to Italy, in the spring of 1873, I stopped at Vintinille, through which the train from Italy passed at about nine o'clock at night. It was on the 23d of March. Led by a guide through the dark city, I perceived that three shadows were following to our left along a garden wall near which we were walking. Very much surprised at such a shadow produced without moonshine and without reflections, I spoke of it to my two companions, who recognized it as well as I. It was very strongly and sharply defined. The sky was studded with brilliant stars; but, to our right, there was only Venus as a star of the first magnitude and so exceedingly brilliant that its light appeared alone more brilliant than all the others of the firmament combined.

"The wall was of a dirty, almost grayish-white. Had it been white, our shadows would have been still more marked.

"During the following weeks, at Nice, I renewed the experiment upon paper. The shadow of my fingers, of a lead pencil, or of any object whatever was depicted upon this with the greatest sharpness. Since then, I have often remarked the same phenomenon, which is one that anybody can easily observe, especially if his attention has been previously called to it."

Sir J. Herschel, in his "Outlines of Astronomy," describes the phenomenon as follows: "Under favorable circumstances, Venus projects quite a strong shadow. This should be received upon a white ground. The open window in a room with white walls is the best arrangement. In such a situation I have observed not only the shadow, but the diffraction fringes that border its contour."

We now come to M. Touchet's experiments. Upon an ordinary astronomical telescope, not mounted equatorially, M. Touchet arranged a light camera from which the objective had been removed. In the place of this he put an object that presented details fine enough to give an idea of

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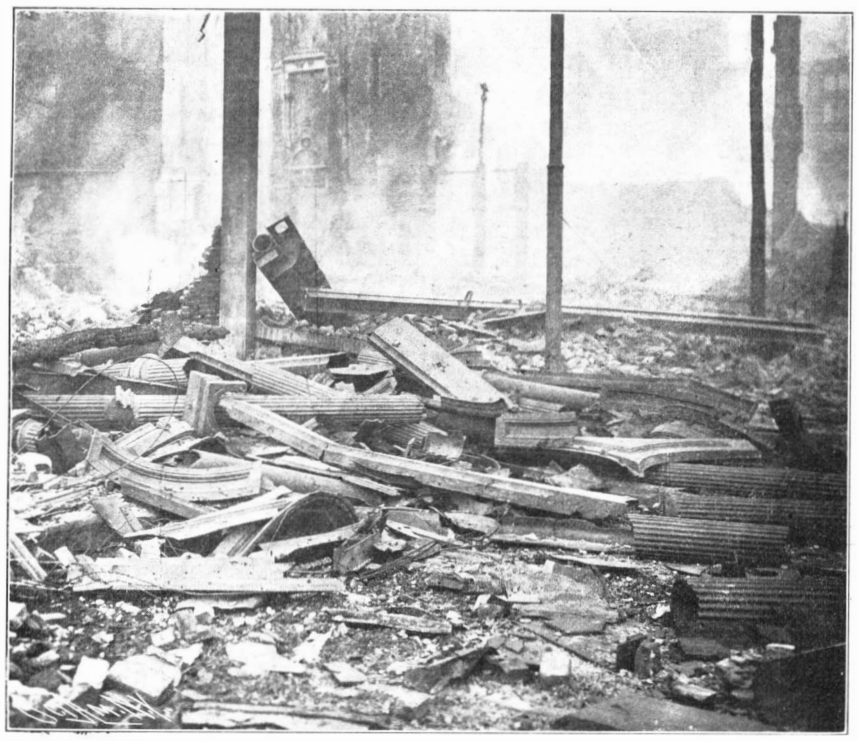
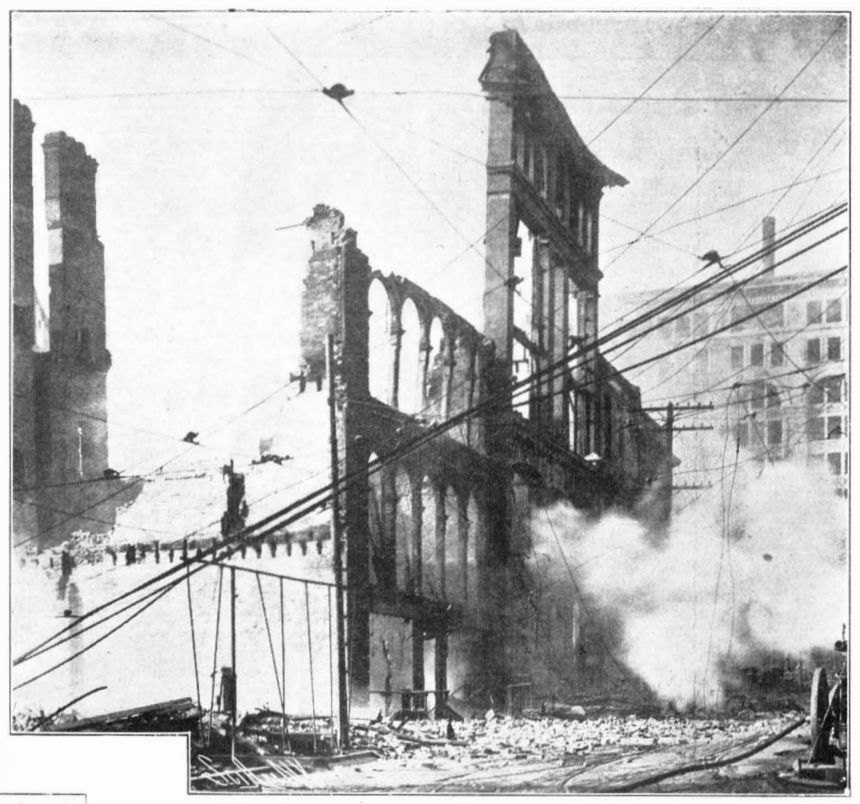
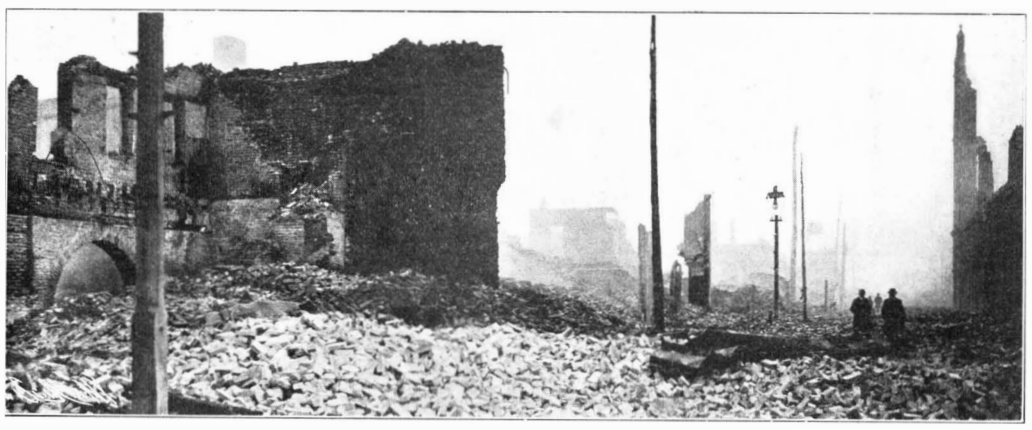


Wreckage of a Cast-Iron-Front Building.



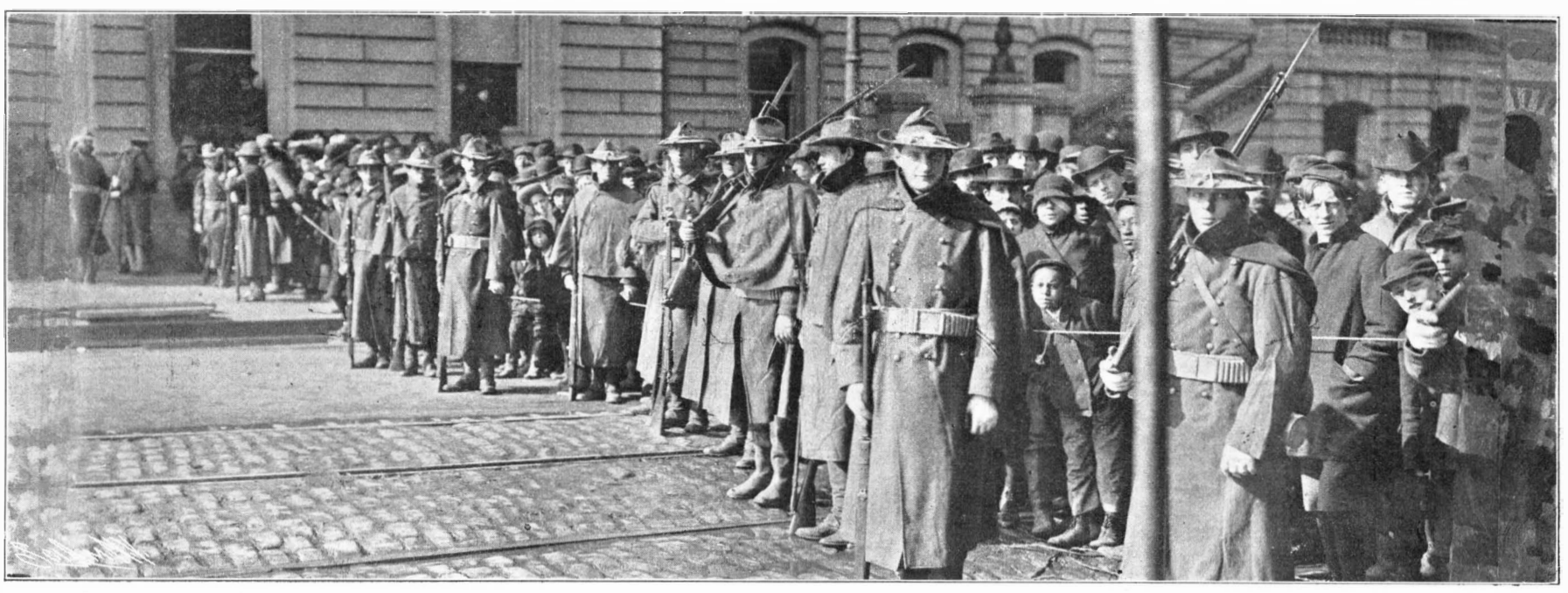
View Showing at End of Street a Burnt-Out Steel Building Standing After the Fire.



Note the Complete Leveling and Disintegration of the Buildings.

Ruins of Hurst & Co.'s Store Where the Fire Started.

On the Edge of the Burned District, Showing the City Hall Tower Intact.



State Militia Keeping the Fire Lines.

THE GREAT BALTIMORE FIRE.—[See page 154.]

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the sharpness of the shadow. This latter was projected at the back of the camera upon a sensitized plate. Finally, in order to obtain the greatest sharpness possible, M. Touchet provided his telescope with its strongest eyepiece, in which there was a hair-cross. Then, everything being ready, he opened the frame, pointed at Venus and uncovered the aperture. He annulled the effect of the diurnal motion by constantly following the planet with his hand and holding it by the hair-cross. In the only experiment that M. Touchet tried, the time of exposure was 15 minutes, and the exposure was made between 6 h. 6 m. and 6 h. 21 m. in the morning. The object that cast a shadow was an incandescent lamp support with a spiral spring. The image was rather weak, and required a strong intensification, but M. Touchet thinks that the weakness was due not to that of the light, but to the poor quality of the plate employed. Finally, the distance between the object and the plate was 21 centimeters. An attentive examination of the negative shows that the shadow is bordered with a very light zone and then with a second and darker one, and finally that the ground is uniform. These are the diffraction fringes observed by Herschel, and of which he speaks in his "Outlines of Astronomy."

Apropos of this, M. Touchet advises those who wish to see the shadow and the diffraction fringes perfectly to direct toward Venus a long blackened box closed by a plate of ground glass and provided with an objective in front. The shadow of the object will be observed to form upon the ground glass very sharply.

The details of the fringes will be seen better still by making use of a lamp and moistening the ground glass with water or applying to it some fatty material, such as petroleum, oil, or glycerine.

For better showing the curious fringes that border the shadow, we give in Fig. 2 an enlargement of the original negative. The smallest details have been registered, and we observe the curious superposition of the fringes at the point of crossing.

We may ask what action the diffused light of the sky has had upon the plate. In making use of a long box this is eliminated almost completely; but, upon the whole, such action is extremely feeble. Toward the end of the experiment above described the dawn was already very sensible. Now, upon the plate, we find, so to speak, no action of the sky. The part of the plate that was under the clips serving to hold it (a part that did not undergo the action of the light) is almost of the same intensity as the depths of the sky.

This first experiment made with the light of Venus having encouraged M. Touchet to take similar photographs of other stars, he tried an experiment with Sirius, the most brilliant of all the stars, and, one fine evening, succeeded in obtaining a photograph of an object exposed to the light of this planet (Fig. 1). The apparatus employed consisted of an ordinary camera of which the objective was replaced by a cardboard tube provided at each extremity with a small pin that cast its shadow upon the sensitized plate. The distance of the pin from the plate was 60 centimeters. The whole was arranged upon an equatorial mounting, and a telescope with a hair-cross permitted of following Sirius during the exposure, which lasted one hour and five minutes. The image, which was quite feeble, was intensified. In consequence of the great length of the tubes, the plate received the diffused light of the sky only just in the direction of the tube, and for so small a portion of the sky the diffused light did not act in a sensible manner.

As may be seen in Fig. 1, the photographed shadow is quite sharp, and round it are seen the diffraction fringes. These same fringes are produced every time that an object is lighted by a luminous point. It was thus that M. Touchet was enabled to obtain a photograph by the light of the Eiffel tower. The negative of this, which we do not reproduce here, shows at the back of the objects illuminated a dozen brilliant fringes bordering the geometrical shadow.

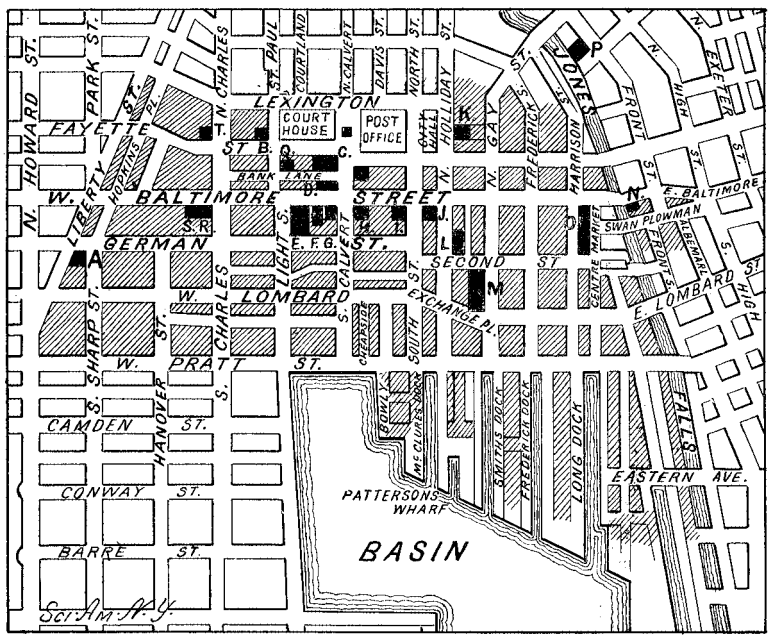
M. Touchet's experiment made with the light of Sirius is very important from the viewpoint of the philosophical conclusions that may be deduced therefrom. The parallax of this star is actually fixed at 0.37 sec., that is to say, that from Sirius the great axis of the terrestrial orbit subtends 0.37 sec. Upon calculating the corresponding distance, we find that the abyss that separates Sirius from our sun is about 83 trillion kilometers.

The light, in order to make this journey, which to us is immense, takes nine years. The luminous waves that in 1903 furnished the image of the small pin, had thus traveled since 1894 at the enormous velocity of a hundred thousand kilometers a second, but they still preserved sufficient energy to act upon the bromide of silver of the sensitized plates. Our mind remains astounded in thinking of the feebleness of such luminous impression acting upon our chemical substances as compared with the immensity of the distance and with the splendor of this brilliant star, one of the most beautiful jewels in the southern heavens.

THE GREAT BALTIMORE FIRE.

The disastrous fire which raged for over a day and a half in the heart of the business section of Baltimore on Sunday and Monday, February 7 and 8, will rank as one of the greatest conflagrations in the history of this country. It was comparable indeed in its extent and the vast destruction that it entailed, with such fires as those of Chicago and Boston, a considerable portion of a square mile of the most valuable section of the city being wiped out of existence, with a loss that is conservatively estimated at $125,000,000.

If some destroying genius with a grudge against this historic and prosperous city had planned to strike it a crushing blow, it could scarcely have selected the place or time to better effect. At a little before 11 o'clock on Sunday morning, when the doomed business section of the city was practically deserted and a fresh gale of wind was sweeping through the streets and circling around the towering office buildings, a fierce fire started on what might be termed the windward edge of the financial and wholesale district, and owing to a heavy explosion, which apparently scattered and opened a way for the fire, the conflagration spread so rapidly that it was soon entirely beyond the powers of the Baltimore Fire Department to stay its progress. Growing swiftly in size and intensity as it swept forward through the doomed city, the mass of flame and falling embers no sooner touched a building—old and timbered or modern and fire-proofed, it mattered not—than the structure burst into furious flame, and added its fuel to that of the score of burning blocks behind it. Every device known to the modern art of fire fighting—an art that has been developed to a higher extent in this country than anywhere else in the world—was tried in the endeavor to stay ruin. Dynamite was freely used in the endeavor to cut an open lane across the path of the conflagration; but even this heroic measure, which has so often proved available as a last recourse in great city fires, was fruitless in the presence of the strong wind that was blowing. Masses of burning material were picked up and flung over the gap, starting fresh fires far to the leeward of the blocks of burning buildings.



Shaded Blocks Show District Burnt Over.

THE BALTIMORE FIRE.

When it was realized that the local fire department was inadequate to deal with the situation, help was asked and quickly granted from the nearest cities. Special trains were made up, consisting of flat cars for the fire engines and passenger coaches for the crews, and these were rushed on special schedules to the aid of the doomed city. Philadelphia sent seven or eight engines, and even from New York, nearly 200 miles away, a similar number of engines was dispatched by special train. There is no doubt that the arrival of this timely help, which included, in addition to the detachments above named, fire engines from Washington, Harrisburg, Newark, and several other cities, served to save the city from a destruction of its business section that might have been practically complete. As it is, Baltimore has suffered a loss, the equivalent of which, relatively, would be the wiping out of the Wall Street district in New York, or what is known as "The City," the great financial center of London itself.

The magnitude of the disaster can best be understood by reference to the accompanying map, showing the districts burned. The fire started two minutes before 11 o'clock, and at a time when the wind was blowing from the southwest, in the store of Hurst & Co., which was located at the corner of Liberty and German Streets. Aided by the strong wind, the fire swept at great speed toward the northeast, wiping out one great establishment after another until it reached Lexington Street, when suddenly the wind swung around through half the compass, and blew strongly from the northeast, carrying the destruction through to St. Paul Street, until every building within an area of about a dozen city blocks had been completely burned out or leveled to the ground. Then came another shift of the wind to northwest, a change which meant much to the city of Baltimore; for the fire was now driven in the direction of the water front and what is known as Jones Falls. The fire was borne forward so resistlessly, that within twenty-four hours after the conflagration started, the whole of the area shown in our map had been so thoroughly burned out that there was absolutely nothing of a combustible nature left either standing or fallen. On the arrival of the fire departments from outside cities, they were at once sent down to the neighborhood of Jones Falls, where the most determined struggle was made to stay the further progress of the disaster. The effort was so far successful, that shortly after noon it was announced that the danger was passed and the fire absolutely under control; not, however, until something like fifty city blocks had been devastated.

The appearance of the burnt city as witnessed by a member of our staff beggars description. The financial district was made up of buildings that varied greatly in age, size, and character of construction. Baltimore during the past few years has been undergoing that gradual reconstruction which is characteristic of any modern American city. In a single street there might be seen buildings that were representative of construction in almost every decade of the past century, one or two richly historical buildings being among those that were burned. The structures that were not of modern fireproof construction varied from the old two or three story characteristic Baltimore house, built fifty to one hundred years ago, to the brick-and-stone and cast-iron structure, with its facing of ornamental cast-iron columns and pilasters, of the latter half of the century, to the most modern steel and masonry office building of fifteen stories or more in height. One would naturally expect that in an assortment of buildings varying so greatly in their construction and their supposed fireproof qualities, there would have been shown varying degrees of ability to resist the fierce heat of the fire; but it needed but one look at the weird desolation to realize that the flames made a clean sweep of everything. In the first place, practically every building that was not of steel skeleton construction was level with the ground, the only evidence of its existence being a mass of bricks that showed signs of having passed through the most intense heat, and occasionally an angle of wall that stood swaying to the wind. Occasionally, rising sheer into the heavens from amid the piles of wreckage, was seen through the mass of smoke the giant form of a so-called fireproof building, whose only title to the claim lay in the fact that it alone was left standing, warped and slightly twisted, and with everything burnt entirely out of it from basement to cornice, except the steel skeleton, the encasing terra cotta, and what remained of the more or less broken floors. As far as the preservation of the buildings themselves is concerned, it is evident that, when put to the supreme test, modern systems of fireproof construction will enable a burnt building to stand where others will fall; but whether the steel skeleton that is thus preserved retains enough of its original strength to form the basis upon which the building may be reclothed and refurnished and given a new lease of life, can only be determined after careful inspection.

This much, at least, has been proved to a demonstration: that so far from these massive structures forming, as it was hoped they would, a fire screen to prevent the onward sweep of a conflagration of this character, they took fire apparently with as much rapidity as the other buildings, and when once alight, burned like a gigantic torch, which threw abroad, high up in midair, large masses of combustible material, to be scattered far and wide over the surrounding buildings. As far as could be seen, most of the burned fireproof buildings were not provided with any steel shutters, or were only partially so provided. Had there been shutters on every window, there is a possibility that the entrance of the fire would have been prevented. On the other hand, it is well known that when such shutters are exposed to the full fury of the flames of a burning building that is adjacent, they will often curl up so badly that the ignition of the interior window frames and sashes is inevitable.

The great lesson of the fire is that, under the contingency of a large and fierce fire, coupled with a gale

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of wind, there is a probability that a huge area of any city lying to leeward of such a fire will be burned beyond all possibility of salvation by the fire department. The ease with which the fire ate up the splendid fireproof structures in Baltimore renders it probable that, if a great conflagration should occur in this city, say, at the Battery, with a heavy southerly wind to spread it, not even the massive wall of office buildings in a district like that of Wall Street could stay its progress.

A Radium Banquet.

The Technology Club of New York city recently held a radium banquet, in which the health of the Massachusetts Institute of Technology, of the alumni of which the association is composed, was drunk in "liquid sunshine."

The lights were turned out, and Lester D. Gardner began the radium display.

Mr. Gardner showed a diamond which glowed when excited by the presence of a bit of radium. He showed kunzite, excited under the same conditions, and then held up a tiny tube, of which he said:

"I hold in my hand a minute portion of pure radium; it is difficult for you who are a few feet away from me to see the small particles in the glass. There are, in this tube, twenty-five milligrammes of radium bromide with an activity one million times as strong as uranium.

"One gramme of this radium would cost $15,000 and one pound would cost approximately, $8,000,000. In the world, all of this radium in existence could be placed on a twenty-five cent piece, and therefore we have before us the rarest specimen of mineral on the earth. With this I intend to excite into luminescence diamonds, willimite and esculin."

Mr. Gardner then produced a dancing skeleton and other objects which had been coated with phosphorus paint, which, he said jocularly, had been impregnated with an infinitestimal quantity of radium to make its radiance permanent. Said Mr. Gardner:

"I now call your attention to radium paint, so called. This is merely a new form of our old friend luminous paint. It has been found that radium exceeds it in luminosity, and when radium can be manufactured in commercial quantities there is no doubt that a production properly called radium paint can be made.

"Many questions have been asked as to the good of radium paint. A friend of mine who owns an automobile says it will solve his difficulty, as people will run a mile when they see his radium-painted automobile dart down country lanes."

Last of all came the "Liquid Sunshine Cocktail." A tiny tube of radium had been placed in water in a tiny cocktail glass. A magnesium wire was burned in a corner of the darkened room and in each glass there glowed a brilliant blue fluorescence.

The toast to alma mater was then drunk from the glasses standing.

The Current Supplement.

Frank C. Perkins opens the current SUPPLEMENT, No. 1468, with an illustrated article on Asiatic Locomotives constructed in Germany. Among the many interesting papers recently presented before the American Association for the Advancement of Science was one on Scientific Investigation and Progress. The paper is published in full. In view of the proposed high-speed tests with electric locomotives to be carried out by the New York Central Railroad, an article on the experimental road of the General Electric Company, by whom the locomotives are to be built, should be of interest. "A Resumé of Recent Progress in the Study of Radium and Radioactivity" is the title of an article which well summarizes recent achievements in this interesting field. Dr. Nordenskjöld describes the results of the Swedish Antarctic Expedition of which he had command. The famous Boscoreale frescoes, now part of the collection of the Metropolitan Museum of Art, are described and reproduced.

A New Radio-active Substance.

It is said that Prof. Markwald has discovered in pitchblende minute quantities of a new radio-active substance associated with tellurium. He has named the substance, on account of its association, "radiotellurium." It seems to be even more difficult to extract than radium, on account of its much smaller quantity.

Some experiments were recently carried out between Liége and Brussels to show the distances in which trains of different weights and traveling at different speeds can be pulled up. The engine was a four-coupled, with 6-foot 6-inch driving wheels. The trials were made on a falling gradient of 1 in 250. With a train weighing 140 tons, traveling at a speed of 77.1 miles an hour, the distance with the quick-acting brake was 959 yards; a train weighing 213 tons, traveling at 73.3 miles an hour, took 756 yards; and a train weighing 216 tons, and traveling at 69.6 miles an hour, was pulled up in 769 yards.

Electrical Notes.

An interesting novelty in electrical construction is a waterproof motor which has been recently installed in the basement of the store of Marshall Field & Co., in Chicago. This motor is made waterproof for the reason that it is used for driving fire pumps and it is essential that its operation should not be interfered with by water. The equipment consists of a 100-horsepower motor geared to a duplex pump operating at 60 revolutions per minute and connected to the sprinkler system which extends to all parts of the building. In these pipes the water is maintained at a pressure of 100 pounds. The pump is under automatic control, so that when the pressure gets below the desired point, the mechanism is set in motion until the one hundred pound point is again reached. The windings are maintained at a safe temperature by the use of a ventilating fan which draws the air in at one side of the motor through a pipe screwed to the casing and discharges it through another at the opposite side. The electrical conductors are led through a similar pipe. The result of this construction is that a stream of water may be played on the motor or it may be entirely submerged without interfering with its operation in the least.

Because of the importance of the electrical transportation interests it has been decided to give this industry some considerable attention at the Louisiana Purchase Exposition, and accordingly an advisory commission has been appointed on electrical railway tests. The personnel of the commission is as follows: J. G. White, of J. G. White & Co., New York city; H. H. Vreeland, president of the Interurban Street Railway Company, New York city; W. J. Wilgus, vice-president of the New York Central & Hudson River Railroad; George McCulloch, president of the Union Traction Company, of Indiana, and J. G. McGraw, president of the McGraw Publishing Company, of New York city. Mr. White will act as chairman of the commission. A 1,400-foot stretch of double track has been laid for the purpose of the tests just north of the Transportation Building and will be equipped for the most complete tests which can be devised. The tests will not take the form of a competition to any great extent, but will be rather for the accumulation of valuable data. The tracks referred to will be connected with the intramural railroad which makes a circuit of the grounds.

More than 150 private and municipal stations have commenced operations in the United States during each year since 1888, and in each of nine years since that date more than 200 have been installed, the greatest number, 277, being reported for the year 1898. As subsequently explained, the term "station" may include two or more electric plants, and as the date of installation of the station only is given, the figures do not indicate the total number of separate plants installed, several having come subsequently under one management. Each state and territory contains a number of central electric stations operated under private ownership, and all, with the exception of three territories, and the District of Columbia, Nevada, and Wyoming, report one or more municipal stations. Illinois contains the greatest number of stations operated under private ownership and Ohio the greatest number under municipal control. The greatest proportion of central electric stations is found in the North Central States. In 1890 these States contained 43.1 per cent of all the electric stations in the United States, and in 1902 the proportion had increased to 47.1 per cent. The greatest percentage of increase in the number of stations is shown for the South Central States, where 79 stations had been installed up to 1890. The number increased to 404 in 1902, or 411.4 per cent.

The suggestions made by Sir Oliver Lodge at the Physical Society as to the possibility of dissipating fog by discharge of electricity into the air have attracted much attention. Experiments proving how a smoke-filled chamber could be cleared by the discharge were shown by Sir Oliver Lodge twenty years ago, and have been repeated by many lecturers since then, but no installation on a large scale was established. In reply to a correspondent who has asked whether street arc lamps could be utilized for the purpose, Sir Oliver Lodge says: "Your suggestion seems a practical one, and it would be a very good thing if something of that kind could be done. The difficulty is the insulation. If that could be guaranteed, the matter would be comparatively easy; but the potential is extremely high—say 100,000 volts. The quantity is next to nothing, and very little power is sufficient if only one could avoid leakage. I can tell you the kind of insulators that we employed for the single mast that I used in Liverpool, but it is a very different thing to try to distribute it over a number of street lamps. It is a matter very well worth consideration, however, and I am glad to find that your attention is called to the matter. In the Liverpool experiment I was using a potential higher than 100,000 volts; one could take sparks 4 inches long. But a good deal smaller voltage would do if there are walls or other earthed surfaces in the neighborhood. For a lofty isolated mast the potential must be higher in order to secure adequate discharge."

Engineering Notes.

The health authorities of the District of Columbia have been making some investigations into the subject of smoke consumption, and a number of inventors and others interested in mechanism of this character were disappointed because there had been no official trials of devices for this purpose. A petition signed by O. G. Staples and others was sent to Health Officer Woodward, demanding such trials, and this was denied, and then the matter was appealed to Commissioner Macfarland, who immediately indorsed the action of the Health Officer. The inventors, it is said, had hoped to get some sort of an indorsement of their devices. Mr. Woodward, in denying the petition, said in part: "The prevention of smoke depends upon the application of certain principles governing combustion, which are more or less thoroughly understood. The application of these principles involves three factors: First, the device in which the combustion is to take place, including the accessories thereto; second, the materials to be burned; and third, the method and conditions under which the device and the materials referred to above are manipulated. That which may be the best device in one place may not be the best in another, the prevention of smoke at any particular establishment being a problem depending on the application of general principles. Under the circumstances, such a test as desired by the petitioners would be of little or no value, and was therefore denied."

A process of making stone from sand has been devised by L. P. Ford, formerly attorney-general of the Transvaal and now a resident of London. Reference is made to the invention in a recent issue of African Trade, which is published in London in the interest of the products of the Dark Continent. It reads in part as follows: Silicate-of-lime stone is made of silica and lime, subjected to heat and pressure, whereby a silica-of-lime stone is formed as a matrix. Mr. Ford's patent is not a concrete, but a chemical combination which has the appearance of a fine-grained sandstone and can be carved easily and cheaply, with as good results as natural stone. It has all the advantages of natural stone and in addition its crushing strength is superior to Portland stone, and it has other points which commend it highly to the building trade. Stanger & Blount, the well-known analysts, say: "Its regularity of fracture indicates great uniformity of texture and strength." It resisted frost and corrosive atmospheres. Those in the business are thoroughly satisfied with its carving qualities, which they say are as good as those of the best natural building stones. It is suitable for use in salt as well as in fresh water, and it hardens with time. In the development of building estates where sand and chalk deposits are more numerous than either natural building stone or brick clays, the silicate-of-lime stone has decided advantages. Bricks, tiles, and paving stones can be made by the process, which is extremely simple. Demonstrations have been made from sand in the various industrial centers. In Johannesburg, Durban, and other parts of Africa, where natural stone and brick earths are rare, the silicate-of-lime stone will be invaluable.

So much reinforced concrete is being used in the construction of buildings of all kinds at present that the subject is being given considerable attention and study by engineers. Blocks of this material when tested to destruction under uniform loading have invariably failed by shear at the ends, the lines of rupture corresponding closely to the lines of principal compressive stress for such a beam. This, then, revealed the weak point of such blocks, and in order to overcome this a new system of reinforcement has been devised by Julius Kahn, a consulting engineer of Detroit, Mich. The novelty in Mr. Kahn's system is that the stirrups are inclined to the vertical and preferably bent to a curvature to approximate the line of the principal stress and are connected rigidly to the main horizontal reinforcing bar. Some tests made recently of this character of reinforcement are of wide interest. A concrete beam with a span of twenty-six feet between supports was loaded with pig iron. At 49,000 pounds no deflection whatever could be detected. When the weight had reached 93,000 pounds, the deflection was five-eighths of an inch. At 110 000 pounds the beam failed at the center, pulling the steel in two at this point. There was not the slightest evidence of weakening of any kind at any other point, which would seem to indicate that the shear had been properly provided for. A company has been formed in Detroit to exploit this new system and several contracts have been already entered into, one of which is for the erection of an army barracks at Washington, D. C., and another is for a cement warehouse at Marlboro, Mich. Estimates are being prepared for a new building for the government at the naval academy at Annapolis, Md., a structure which will entail an expenditure of between two and three million dollars.

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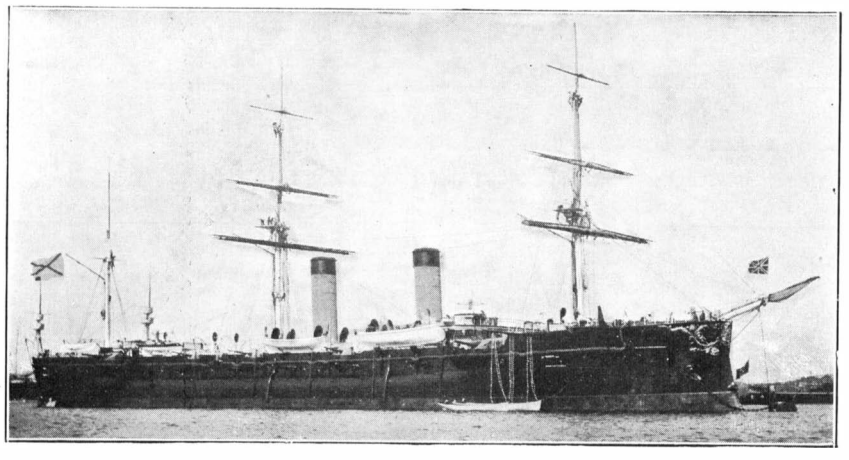
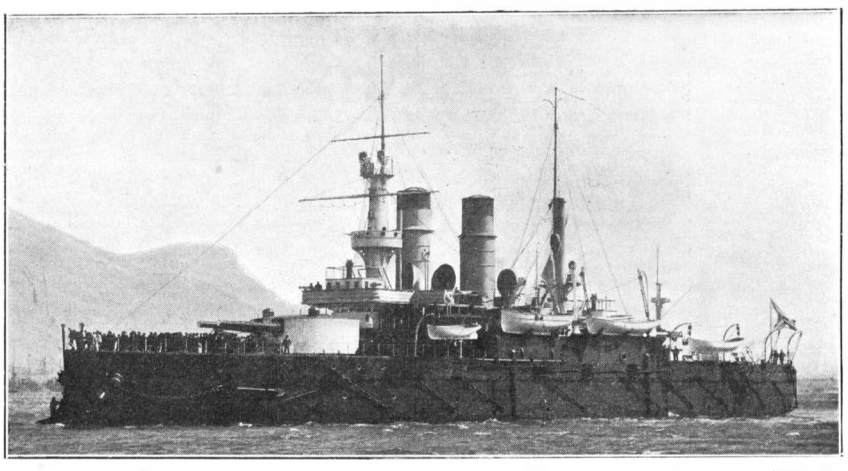


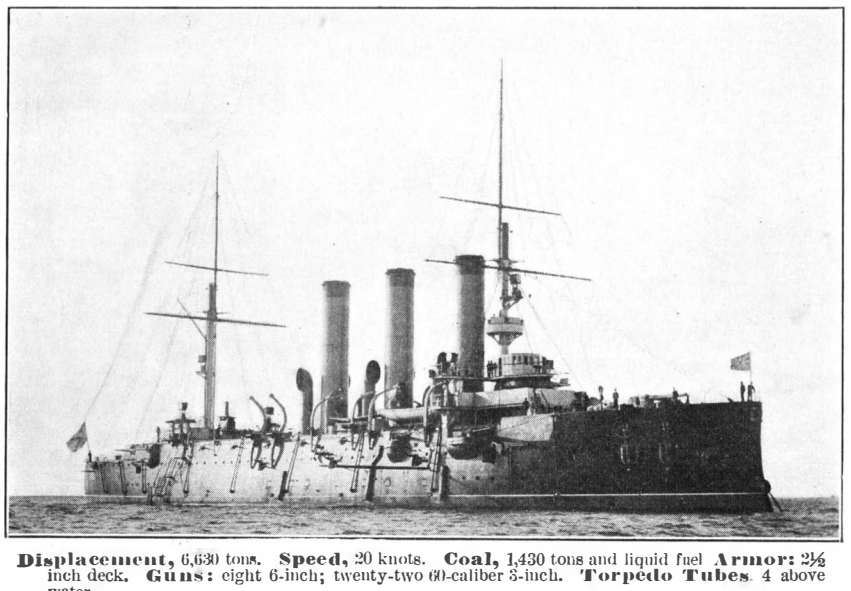
Displacement, 10,950 tons. **Speed,** 18.8 knots. **Coal,** 2,000 tons. **Armor:** belt, 10 inches to 5 inches; deck, 2¾ inches. **Guns:** four 8-inch; sixteen 5.5-inch; six 4.7-inch; 22 small guns. **Torpedo Tubes** 6 above water.

Armored Cruiser "Rurik." Date, 1892. Pacific Fleet.



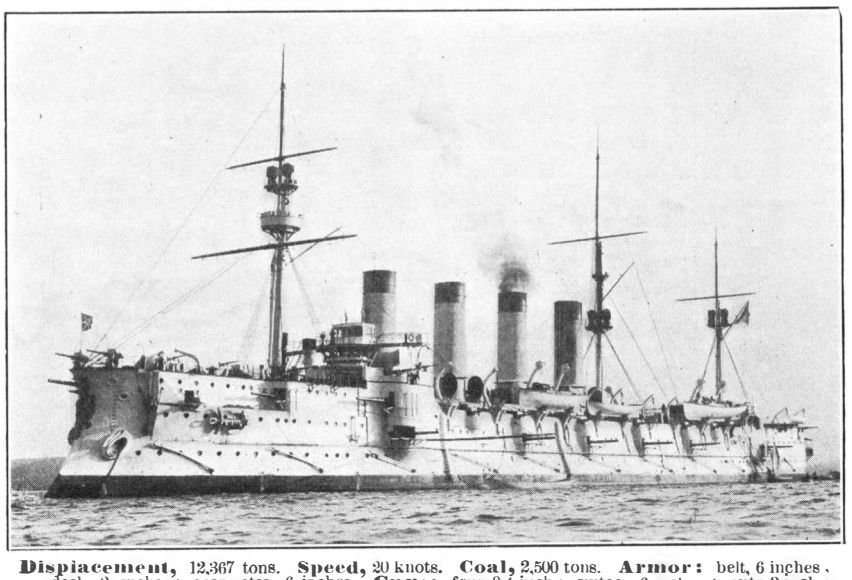
Displacement, 9,000 tons. **Speed,** 16 knots. **Coal,** 800 tons. **Armor** (Compound): belt, 16 inches; deck, 3 inches; side, 5 inches; turrets, 12 inches and 10 inches. **Guns:** four 12-inch; six 6-inch; 38 smaller guns. **Torpedo Tubes,** 6 above water.

Battleship "Sissoi Veliky." Date, 1894



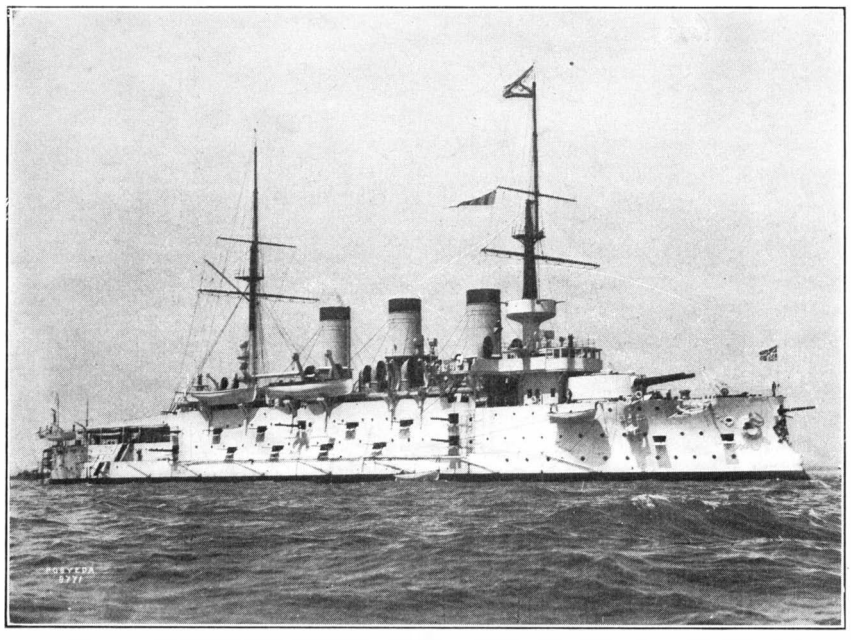
Displacement, 6,630 tons. **Speed,** 20 knots. **Coal,** 1,430 tons and liquid fuel **Armor:** 2½ inch deck. **Guns:** eight 6-inch; twenty-two 60-caliber 3-inch. **Torpedo Tubes** 4 above water.

Protected Cruiser "Pallada." Date, 1899. Disabled by Japanese.



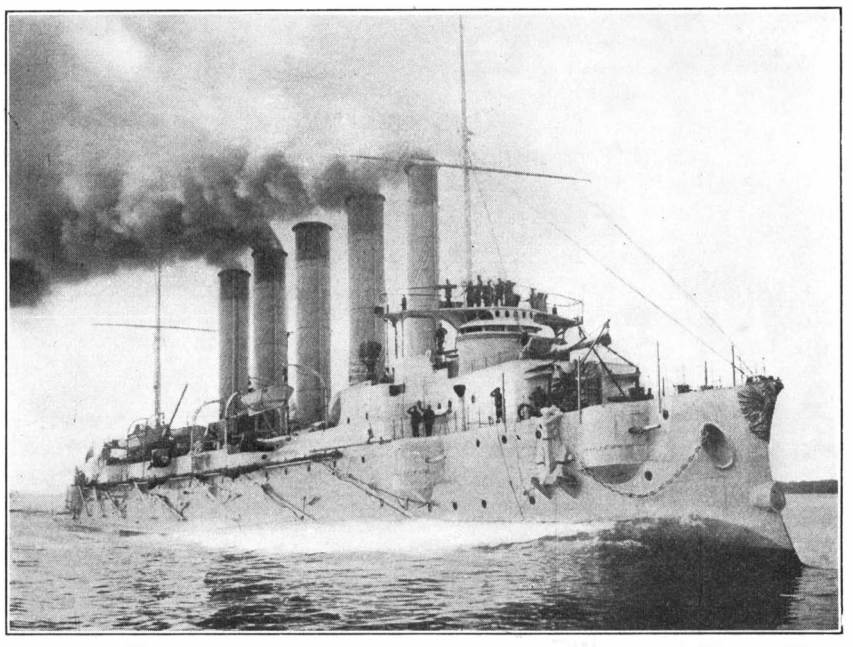
Displacement, 12,367 tons. **Speed,** 20 knots. **Coal,** 2,500 tons. **Armor:** belt, 6 inches, deck, 2 inches; casemates, 6 inches. **Guns:** four 8.4-inch; sixteen 6-inch; twenty 3-inch; 24 small guns. **Torpedo Tubes,** 2 below, 2 above water.

Armored Cruiser "Gromoboi." Date, 1899. Pacific Fleet.



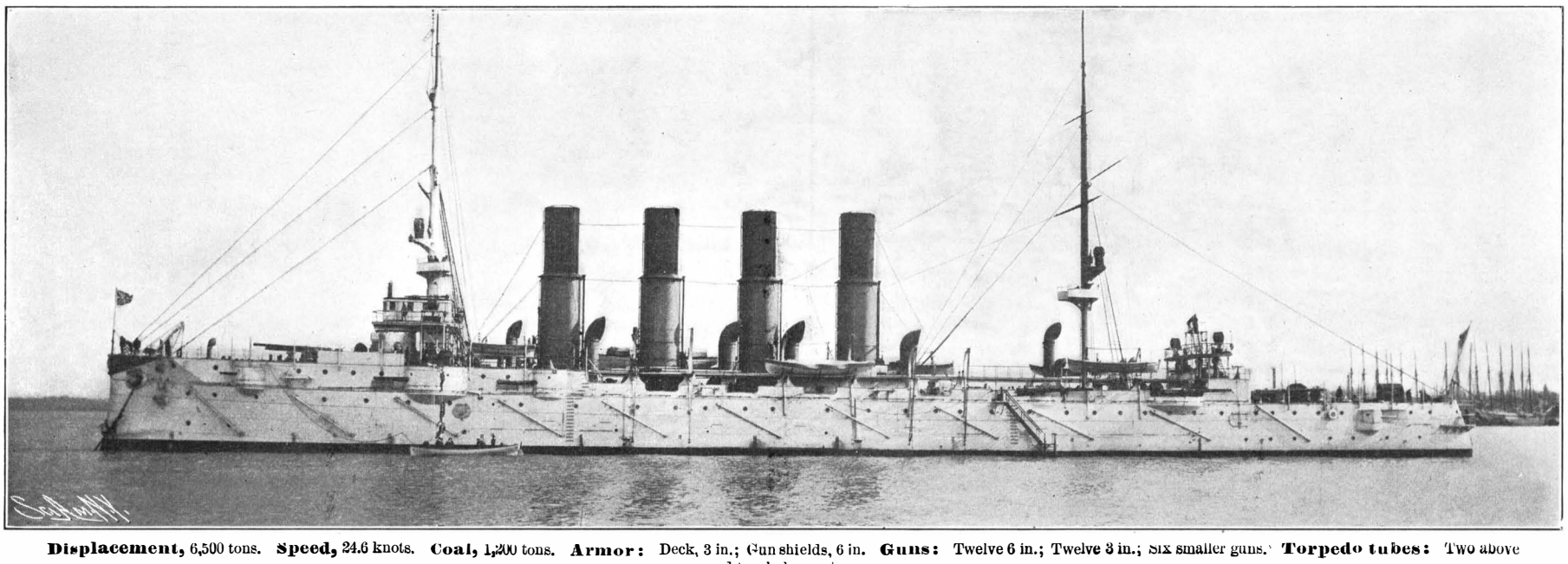
Displacement, 12,670 tons. **Speed,** 18 knots. **Coal,** 2,000 tons. **Armor** (Krupp): belt, 9 inches to 4 inches; deck, 2¾ inches; side, 5 inches; turrets, 10 inches; casemates, 5 inches. **Guns:** four 10-inch; eleven 6-inch; twenty 3-inch; 26 small guns. **Torpedo Tubes,** 2 submerged, 4 above water.

Battleship "Pobieda." Date, 1900. Pacific Fleet.



Displacement, 6,560 tons. **Speed,** 23 knots. **Coal,** 1,100 tons. **Armor** (Krupp): deck, 2 inches. **Guns:** twelve 6-inch; twelve 3-inch; ten small guns. **Torpedo Tubes,** 2 above, 4 below water.

Protected Cruiser "Askold." Date, 1900. Disabled by Japanese.



Displacement, 6,500 tons. **Speed,** 24.6 knots. **Coal,** 1,200 tons. **Armor:** Deck, 3 in.; Gun shields, 6 in. **Guns:** Twelve 6 in.; Twelve 3 in.; Six smaller guns. **Torpedo tubes:** Two above and two below water.

Protected Cruiser "Variag." Built 1899 at Philadelphia Sunk by Japanese.

THE RUSSIAN NAVY.

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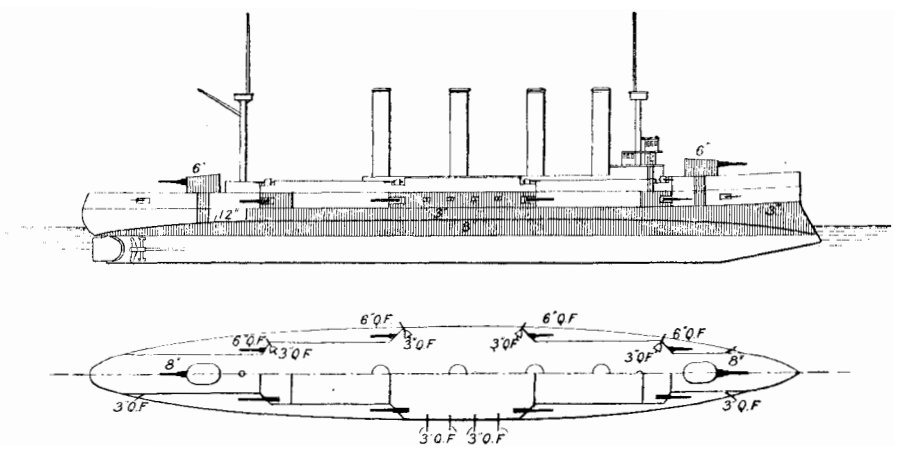
THE RUSSIAN NAVY.

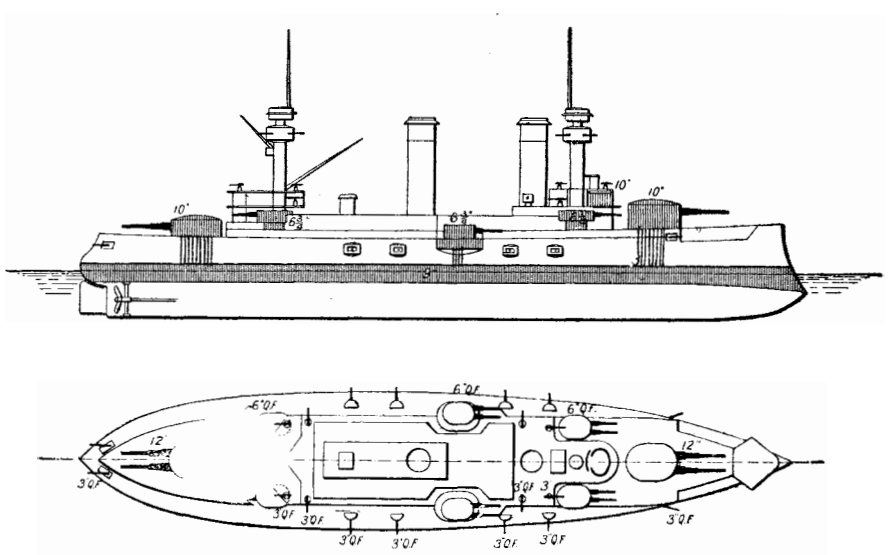
It is difficult to calculate at any given time the exact fighting strength of the Russian navy, and this for the reason that access to her dockyards is forbidden, and considerable efforts are made to preserve secrecy as to the exact condition of the ships that are under construction.

Speaking first of battleships, we find that the latest addition authorized by the government is a class of half a dozen new ships, of which the following are the leading particulars: Displacement, about 16,000 tons; speed, 18 knots; armor, a continuous belt, tapering from 11 inches amidships to 6 inches at the ends; a 4-inch protective deck; 6-inch side armor above the belt; with a second armored deck 2 inches thick forming the gun-deck; and 11 inches of armor on the main turrets. The armament consists of four 12-inch guns in two turrets, twelve 8-inch guns in six turrets, and twenty 3-inch guns, with two submerged and three above-water torpedo tubes. These dimensions, however, are tentative, and may have been considerably modified. It is probable that but little has been done upon these ships as yet. Next we have the "Borodino" class of six ships, of which one, and possibly two, are completed, and the others well advanced. These are fine vessels of 13,566 tons displacement and a designed speed of 18 knots. They measure 397 feet by 76 feet by 26 feet draft, and are characterized by a lofty spar-deck, whose elevation above the water-line must be fully 30 feet, extending from the bow to the quarter-deck. Forward on this deck is mounted a pair of 12.4-inch, 40-caliber guns, in a turret protected by 11 inches of Krupp armor. Aft on the quarter-deck, and at about 8 feet less elevation, is another pair of 12.4-inch guns protected by a turret armed also with 11 inches of Krupp steel. The intermediate battery of 6-inch 45-caliber guns is disposed as follows: Eight of them are mounted in four turrets protected by 6-inch armor and located two forward of the superstructure, flanking the forward 12.4-inch guns, and a little abaft of the same, and two in turrets aft flanking the after 12.4-inch guns. These four turrets have the same command of probably 36 feet as the forward 12.4-inch guns. Amidships on either beam is a pair of 6-inch guns mounted in turrets protected by 6 inches of armor. The twenty 3-inch guns are mounted four in the bow, four in the stern, and six on either broadside. These vessels carry two submerged broadside torpedo tubes and two above-water, one in the bow and the other in the stern. An interesting feature of these vessels is that an endeavor is made to localize the effect of a blow from the torpedo. This is done by running two vertical longitudinal bulkheads of 4-inch armor throughout the whole length of the ship at a distance of 9 or 10 feet inboard from the ship's sides. The protection to the vitals is particularly complete, consisting of a belt tapering from 9 inches to 4 inches, a protective deck 4 inches thick on the slopes, and a second protected deck 2 inches in thickness at the level of the gun-deck. A similar ship to the "Borodino" class is the "Czarevitch," built at La Seyne, France, in



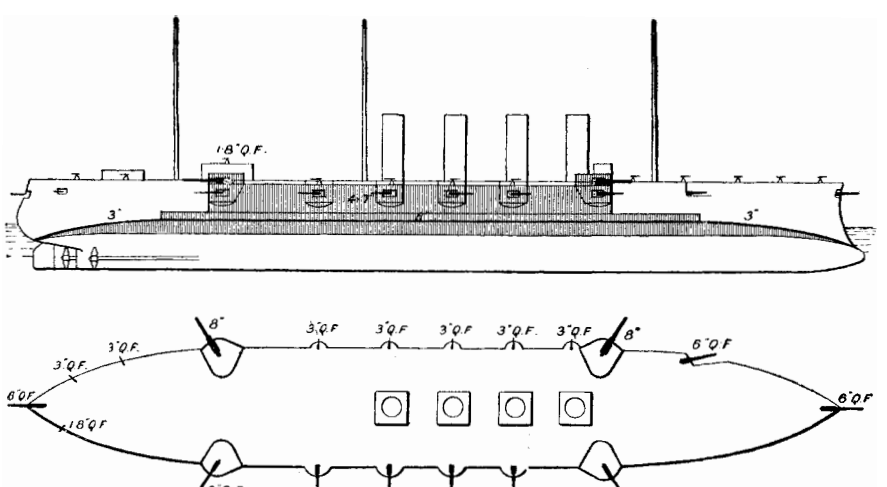
Armored Cruiser "Bayan." Pacific Fleet.

Displacement, 7,800 tons. **Speed,** 21 knots.



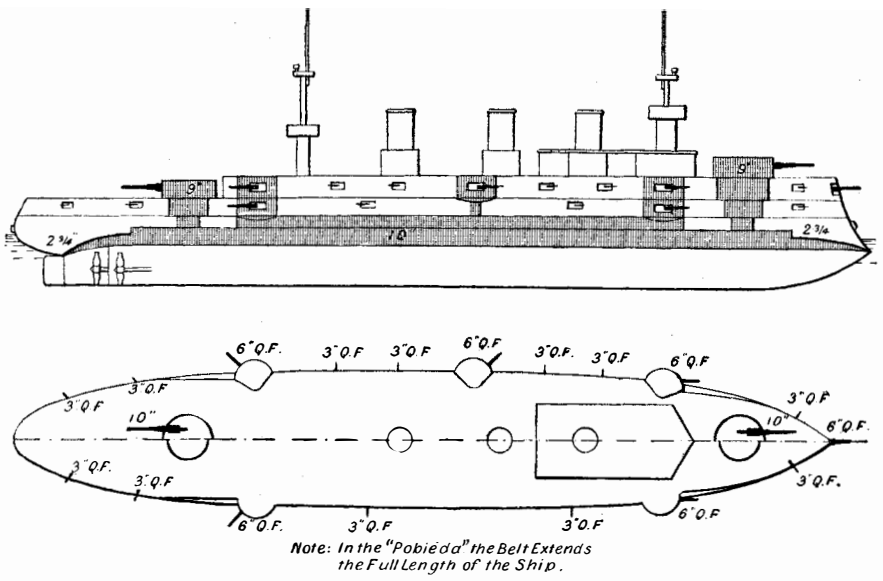
Battleship "Czarevitch."

Displacement, 13,000 tons. **Speed,** 18 knots.



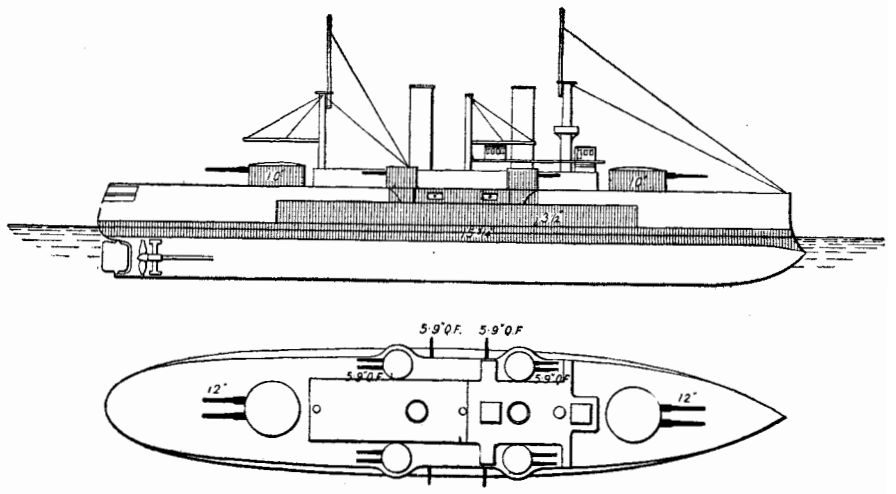
Armored Cruiser "Gromoboi"

Displacement, 12,367 tons. **Speed,** 20 knots.



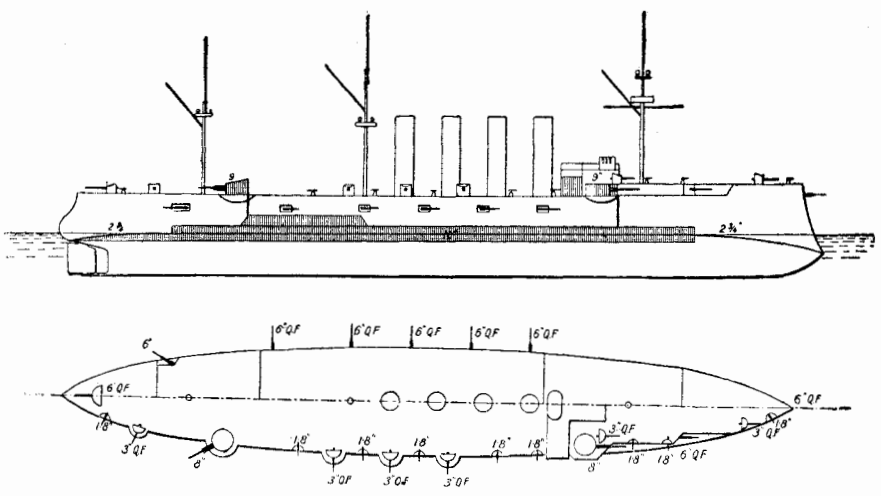
Battleship "Pobieda." Class of Three Ships. Includes "Peresviet" and "Osliabia."

Displacement, 12,670 tons. **Speed,** 18 knots.



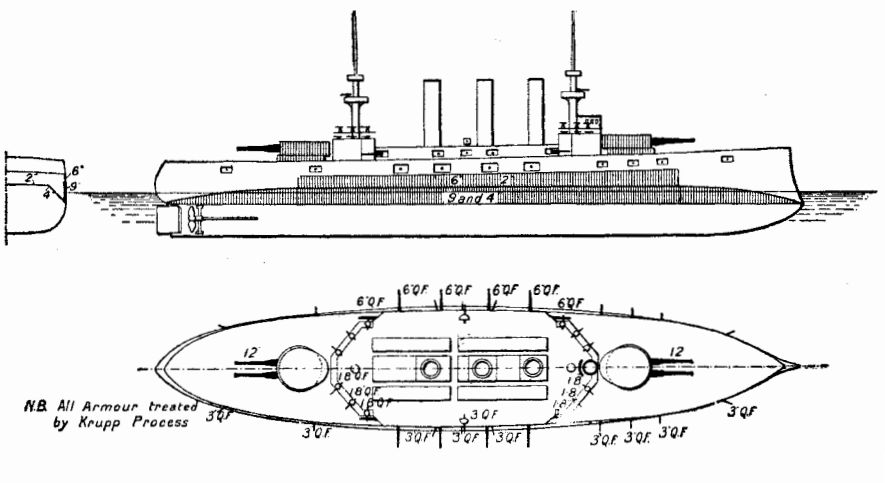
Battleship "Poltava." Class of Three Ships. Includes "Petropavlovsk" and "Sevastopol."

Displacement, 11,000 tons. **Speed,** 17 knots.



Armored Cruiser "Rossia."

Displacement, 13,500 tons. **Speed,** 20 knots.



Battleship "Retvizan."

Displacement, 12,700 tons. **Speed,** 18.8 knots.

THE RUSSIAN NAVY.

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1901, and sunk at Port Arthur. Her displacement is 13,000 tons, and she evidently was so satisfactory to the Russian naval authorities that they took her as a model for the two later classes of battleships above described. She has a continuous belt varying from 10 inches amidships to 2½ inches at the ends. Above this belt is a second complete belt of armor, which extends as high as the gun-deck, and tapers from 6 inches amidships to 2½ inches at the ends. At the top of this belt is the gun-deck, which is formed of 2 inches of steel. The number of guns and the quality of their protection is similar to that of the "Borodino" class, and the distribution of the turrets is about the same. The 12.4-inch guns forward and aft are carried in turrets armed with 11 inches of steel; the twelve 6-inch guns are carried in six turrets protected by 7 inches of steel; while the bases of the turrets are protected by 10 inches of steel in the case of the 12-inch guns, and by 5 inches in the case of the 6-inch guns. There are also two longitudinal bulkheads of 1½-inch steel extending in the wake of the magazines and engine rooms, and located about 9 feet from the side of the vessel. It will thus be seen that the amount of armor carried by this vessel is exceptional, her protection being more complete than that of any ship afloat. The longitudinal bulkheads were supposed to render her torpedo-proof, and it is probable that it was the existence of these bulkheads that served to keep the "Czarevitch" afloat at Port Arthur until she could be brought into harbor and beached. Another peculiar feature in these ships is the heavy concentration of fire forward and aft, which consists of two 12.4-inch guns and eight 6-inch. The loss of the "Czarevitch" removes the finest and most modern of the Russian battleships from the theater of war, probably for many months, if not permanently.

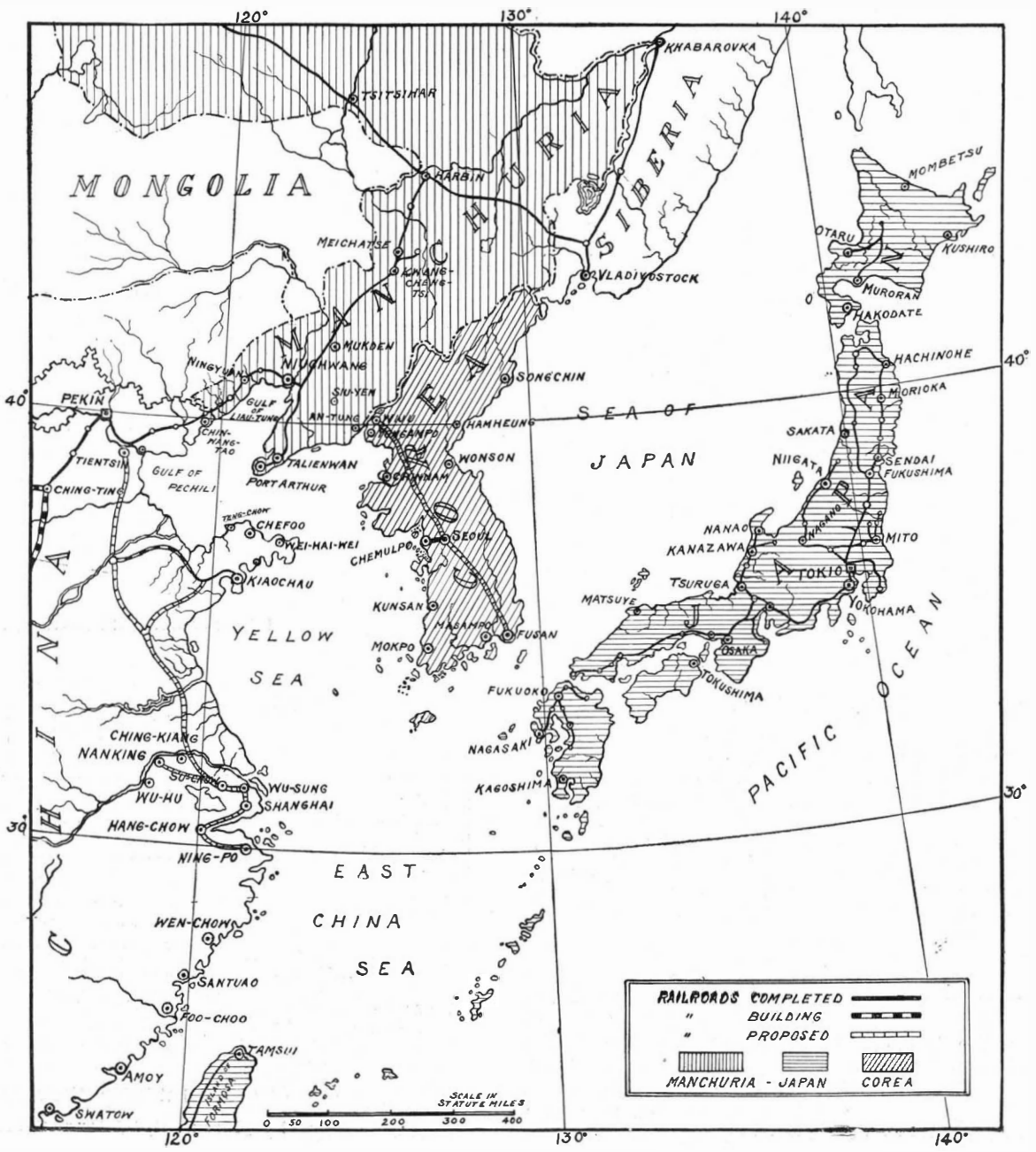
The next two battleships in point of importance are the "Tavritcheski" and the "Retvizan," the latter built at Philadelphia in 1900, and torpedoed in the first twenty-four hours of the war at Port Arthur. The "Tavitcheski" is of 12,500 tons displacement and 18 knots speed. She is protected by a partial belt, which is 9 inches thick amidships, and by a curved protective deck, which is 4 inches over the vitals and tapers to 3 inches at the ends. Above this belt the side armor is 6 inches in thickness up to the level of the main-deck, and then 5 inches to the level of the spar-deck. The armament consists of four 12-inch guns carried in turrets of 12-inch Krupp armor, and sixteen 6-inch guns, of which twelve are carried on the main-deck within a broadside battery, protected by 5 inches of armor, and four are carried in broadside on the spar-deck behind casemates protected by 5 inches of armor. There are also fourteen 3-inch guns and twenty smaller guns. There is one submerged torpedo tube at the bow below the ram, two submerged torpedo tubes on either broadside near the bow, besides two above-water torpedo tubes. This ship is arranged to burn oil, with facilities for a rapid change to coal fuel, if desired. The "Retvizan," built by Cramps in 1900, is of 12,700 tons, and carries four 12-inch guns protected by 10-inch armor turrets, twelve 6-inch, protected by 5-inch armor, eight of them being carried in a central battery on the gun-deck, four of them in casemates on the main-deck. There are also twenty 3-inch guns mounted on the main-deck in broadside and twenty-six smaller guns. The vessel has two submerged and four above-water torpedo tubes. She has a partial belt which varies from 9 inches to 7 inches in thickness and a 3-inch protective deck. This fine vessel made 18.8 knots on her trial, and can carry a maximum coal supply of 2,000 tons. Like the "Czarevitch," she is now the victim of the Japanese torpedoes, and has been beached on the mud inside the harbor of Port Arthur.

The "Poltava" class of three battleships, built in 1894-1895, forms part of the fleet at Port Arthur. The "Poltava" herself was another of the victims of the great sea fight, being crippled by a hole below the waterline. The other two ships, the "Petropavlovsk" and the "Sevastopol," are similar vessels of 11,000 tons and 17 knots speed, protected by a partial belt of 15-inch Harvey armor, a 3½-inch protective deck, with 9-inch transverse bulkheads at the ends of the armor belt. Above the belt, for the height of one deck, the side armor is 4 inches in thickness. The armament consists of four 12-inch guns carried in 10-inch-armor turrets with 6-inch armor bases, eight 6-inch guns carried in 6-inch armor turrets with 5-inch armor bases, these turrets being arranged two on each broadside, so that four of them can fire dead ahead and four dead astern. There are also four 6-inch guns, two on each broadside on the main-deck between the turrets and protected by 5-inch armor casemates. There are also sixteen 3-pounders and twenty smaller guns. Each vessel carries six above-water torpedo tubes.

The battleship "Tri-Sviatitelia" of 12,500 tons and 18 knots speed, built in 1893, is a low-freeboard vessel with a partial belt of 16-inch Creusot armor and a 3-inch deck, and is of considerably less value than the preceding ships. There are four 12-inch guns carried in two 16-inch armor turrets mounted on 16-inch armor redoubts. There are eight 6-inch guns mounted behind a 5-inch armor broadside battery on the main deck and four 4.7-inch guns mounted on the spar-deck. The vessel can carry 1,000 tons of coal, and was designed for a speed of 18 knots. The "Rostislav," built in 1897, of 9,000 tons and 18 knots speed, and the "Sissoi Veliky," of the same tonnage and 16 knots speed, are practically sister ships, with partial belts. They mount their main armament of four 12-inch guns in two turrets. The "Rostislav" carries her intermediate battery of 6-inch guns in four 6-inch armor turrets, two on each broadside; the sister ship carries her six 6-inch guns in a central battery protected by 5-inch armor. Each vessel has six above-water torpedo tubes. The waterline belt of the "Rostislav" is of 15-inch Harvey armor, and that of the sister ship of 16-inch Creusot armor.

Three of the finest battleships in the Russian navy are the sister ships "Pobieda," "Peresviet," and "Osliabia," of 12,670 tons and 18 knots speed. They are ships of extremely high freeboard, a good thing for the guns, but a very bad thing for the ship herself, considered as a target for the enemy. They have Harvey belts of 9 to 4-inch armor, with a belt of 5-inch armor extending amidships above the main belt. They carry four 10-inch guns in 10-inch armor turrets, ten 6-inch guns in 5-inch armor casemates, and one 6-inch gun firing through the bow on the main-deck. There are also twenty 3-inch and twenty-six smaller guns, two submerged torpedo tubes and four tubes above water. These three vessels are in the Pacific, and escaped in-

RUSSIAN FLEET AT COMMENCEMENT OF THE WAR.					SHIPS DISABLED IN FIRST 24 HOURS OF WAR.			
	Number of Ships.	Average speed in knots.	Average displacement in tons.	Displacement in tons.	Number of Ships.	Average speed in knots.	Average displacement in tons.	Displacement in tons.
Battleships, 10 years old or less	13	17.3	11,790	153,276	3	18	12,233	36,700
Battleships, 10 to 20 years old or less	7	16.0	9,933	69,600				
Totals	20	....	....	222,876	....	....	....	....
Coast Defense Vessels	3	16.0	4,129	12,387	....	....	....	....
Armored Cruisers, 9,000 tons or over	3	19.6	11,979	35,817		....	....	
Armored Cruisers, 7,000 to 9.000 tons	2	20.0	7,900	15,800	....	....	....	....
Totals	5	....	....	51,617	....	....	....	....
Protected Cruisers, 4,000 to 7,000 tons	11	20.2	6,352	69,880	4	22	6,500	26,000
Protected Cruisers, 2,000 to 4,000 tons	6	23.4	3,250	19,500	2	24.2	3,100	6,200
Totals	17	....	....	89,380	....	....	....	....
Small Cruisers and Gunboats	13	18.5	846	11,000	2	11	1,500	3,000
Grand Totals	58	....	....	387,260	11	....		71,900
Destroyers	50	27.5	300	15,000	....	....		
Torpedo Boats, 1st Class	54	24	120	6,480	....	....	....	
Torpedo Boats, 2nd Class	12	21	85	1,020		....		
Totals	116	....	....	22,500	....		....	....
Obsolete Torpedo Boats	100	....	....	....	....	....	....	....



MAP OF THE THEATER OF THE RUSSO-JAPANESE WAR.

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jury as far as known in the recent fighting. Of less important battleships on the European station, there are the "Navarin," of 10,000 tons and 16 knots speed, and the "Apostoloff," 8,500 tons and 16½ knots speed, whose main armament consists of four 12-inch guns in turrets and, in the case of the "Navarin," eight 6-inch guns in broadside, and in the case of the sister ship four 6-inch guns mounted in broadside. These vessels have partial belts of compound armor. Of course, they are now relegated purely to duties of coast defense. Then there are the three vessels of the "Sinop" class, of 10,500 tons displacement and 16½ knots speed. They have 16-inch belts, and a 12-inch central redoubt, within which are six 12-inch guns, protected by the redoubts and by hoods of 2-inch armor. These vessels also carry seven 6-inch guns on the main-deck. The "Nikolai I." and "Alexander II." are old battleships of 9,800 tons and 15½ knots speed, protected with 14-inch compound armor belts and carrying two 12-inch guns in a turret forward and four 9-inch and eight 6-inch in a battery on the gun-deck.

The Russian navy also includes three fairly modern coast defense vessels built in 1895, of 4,126 tons and 14 knots speed. They carry some of them three and some of them four 9-inch guns in turrets, and four 6-inch guns in the central battery. They have a partial 10-inch belt, and a 3-inch armored deck.

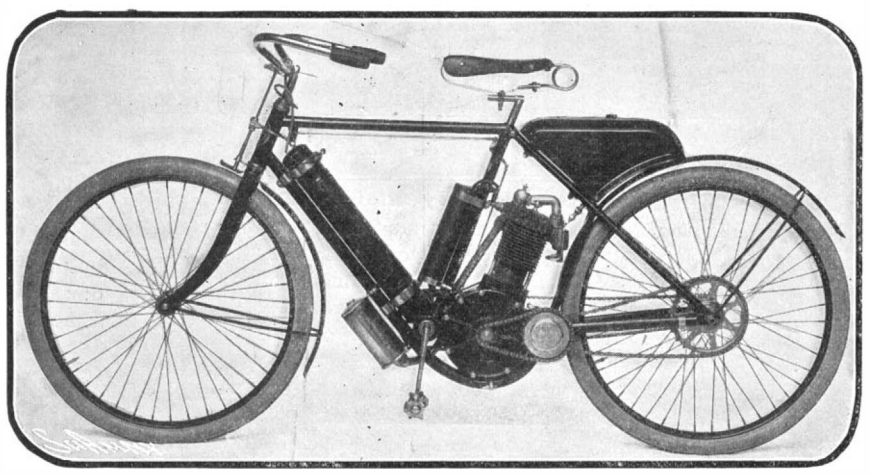
The Russian navy includes four large modern armored cruisers. The "Gromoboi," built in 1899, is of 12,367 tons and 20 knots speed, with a bunker capacity of 2,500 tons of coal, and provision for liquid fuel. The vessel has a partial 6-inch belt, a 2-inch deck, and 6 inches of armor on the casemates. She carries four 8.4-inch guns, sixteen 6-inch, twenty 3-inch, and twenty-four smaller guns, besides two submerged and two above-water torpedo tubes. She is practically an improved "Rossia," and the description of the "Gromoboi" will apply to the "Rossia," with the difference that the armor belt is 10 to 5 inches in thickness, and that she carries six above-water torpedo tubes. The "Rurik," of 10,950 tons and 18.8 knots speed, has a partial 10 to 5-inch belt and carries four 8-inch, sixteen 5.5-inch, six 4.7-inch, twenty-two smaller guns, and six above-water torpedo tubes. Although much smaller than the other vessels, the "Bayan," built at La Seyne in 1900, is the best designed of the armored cruisers. She is of 7,800 tons and 21 knots speed, has an 8 to 4-inch belt, 2-inch deck, and carries two 8-inch guns in 7-inch armored turrets, eight 6-inch guns in 6½-inch armor casemates, twenty 3-inch and seven smaller guns, besides two submerged torpedo tubes. There is also the "Nakhimoff," built in 1885, and rebuilt in 1899, which carries a 10-inch partial compound armor belt and mounts eight 6-inch, ten 4.7-inch, and several smaller guns.

Coming now to the protected cruisers, we have a class of six splendid vessels of about 6,500 tons displacement and speeds that vary from 20 to 24 knots. They have about the same armor and armament; and a description of the "Variag," which was built at Philadelphia and destroyed in the recent sea fight off Chemulpo, will answer for the class.

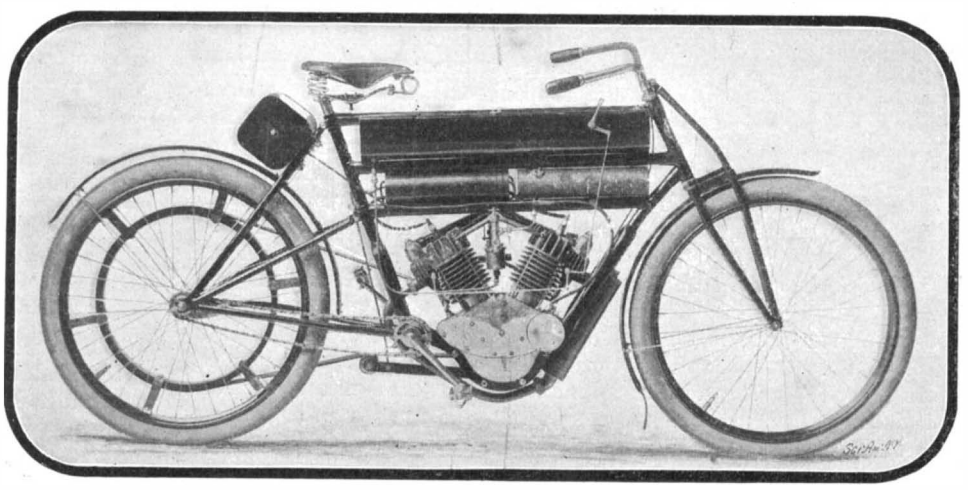
The "Variag" is, or rather was, of 6,500 tons displacement, 24.6 knots speed, and was protected by a 3-inch deck and by gun shields 6 inches or less in thickness. She carried twelve 6-inch, twelve 3-inch, and six smaller guns, besides two submerged and two above-water torpedo tubes. The other vessels of this class are the "Bogatyr," built at Stettin; the "Askold," a five-funneled boat built by Krupp; the "Pallada" and "Diana," both crippled at Port Arthur; and the "Aurora." Of the four other large protected cruisers, it is sufficient to say that, because of their age, they are in no way comparable to the foregoing ships. The "Pamiat-Azova," of 6,700 tons and 18.8 knots, is the best. She carries fourteen 6-inch guns, and has a partial belt of the old compound armor, which is not comparable in protective qualities to the modern steel protective decks. The "Dimitri Donskoi," of 5,800 tons, now on her way to the Pacific, and two other vessels, the "Monomakh" and "Korniloff," are protected by easily-penetrated compound-armor belts, and are armed with a numerous battery of 6-inch and 4.7-inch guns. They are of slow speed and doubtful utility against modern ships. The "Svietlana," built at Havre in 1896, is a serviceable 3,900-ton ship of 20 knots speed, with a 2-inch deck, mounting six 6-inch, twelve 3-pounders, and four above-water torpedo tubes. The "Novik," the fastest protected cruiser in the world, now disabled at Port Arthur, and the "Almaz" are 3,000-ton protected cruisers of 26 knots speed, carrying six 4.7-inch guns and eleven smaller guns. They have a 2-inch deck, and are provided with five torpedo tubes, all located above the water line. Lastly, we have the three vessels of the "Boyarin" class, of 3,200 tons displacement and 22½ knots speed, protected by a 2-inch deck and carrying six 4.7-inch guns, eight smaller guns, and five above-water torpedo tubes. The "Boyarin" is another of the ships that was disabled at Port Arthur.

In addition Russia also possesses thirteen small cruisers and gunboats that range from 1,500 to 534 tons in displacement, two of the best of which have already been accounted for by the Japanese in the early days of the war. The torpedo-boat fleet consists of fifty destroyers, fifty-four first-class and twelve second-class torpedo boats, all of modern and first-class construction.

Besides these there are over 100 small torpedo boats of such early construction as to be practically obsolete. Before the opening of the war the personnel of the Russian fleet was something of an unknown quantity. It was supposed, however, to be very good; but until some reasonable explanations are forthcoming of the early reverses of the war, the public will conclude that the excellent Russian ships and general war material are vastly superior to the men who handle them.



2¼ H. P. COLUMBIA MOTOR BICYCLE.



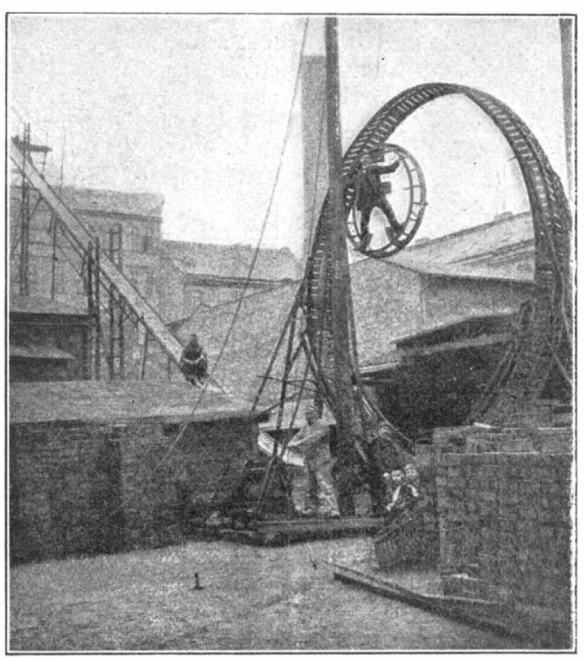
5 H. P. TWIN-CYLINDER CURTIS ROADSTER.

TWO NEW MOTOR BICYCLES.

One of our cuts shows a motor bicycle with an air-cooled V-shaped motor of 5 horse power, which made the fastest time at the recent Florida Race Meet. The machine is made by the G. H. Curtis Manufacturing Company, Hammondsport, N. Y., and it is intended for use as a powerful roadster for use on all kinds of American roads. Its weight complete is but 165 pounds, and it has gasoline and oil tanks of sufficient capacity for traveling 150 miles. The double-cylinder, V-shaped motor is placed in a 23-inch frame, and transmits its power directly to the rear wheel by means of a 2-inch flat belt made of two-ply Russian rawhide. A wooden pulley is used on the rear wheel, and a leather-covered pulley on the motor. The motor itself weighs but 60 pounds, has a 3-inch bore and stroke and develops 5 horse power at 2,000 R. P. M., thus making the bicycle one of the most powerful motor cycles ever built for use as a regular road machine. The crank shaft runs on roller bearings in hardened and ground steel bushings. The two cylinders add greatly to the flexibility of the motor, and make it possible to obtain a wide variation in speed. With the regular gear of 4 to 1, the machine will climb any hill where the road is of fairly good surface, and will travel at the rate of 45 miles per hour on the level. With the racing gear of 2½ to 1, it made a mile in 59 1-5 seconds and 10 miles in 8:45 2-5 on the Ormond-Daytona Beach.

The switch and spark advance are controlled by turning the left grip, while the exhaust valves can be raised by a small lever on the frame. The batteries and spark coils are placed across the upper part of the frame, the gasoline tank behind the seat. The carbureter is seen between the two cylinders of the motor. The company also builds a single-cylinder, 120-pound, 2½-horsepower machine. The two sizes of machines are respectively fitted with 2½ and 2-inch detachable tires, and have a 62 and 58-inch wheel base.

The new Columbia motor bicycle, built by the Pope Manufacturing Company, of Hartford, Conn., has a chain drive through a speed-reducing countershaft to the rear wheel. The sprocket of the former, on which runs the chain from the motor, is fitted with two coiled springs, which transmit the power, yet absorb the shocks of the explosions. The motor has a 2¾-inch bore and a 3¼-inch stroke. High compression is used in it, and, at a speed of 2,500 R. P. M., it will drive the bicycle 35 miles an hour. All the Columbia machines are run up a hill of 25 per cent grade, which they must climb at a 15-mile-an-hour rate as a final test. The arrangement of parts is readily seen in the cut. The batteries are in a case above the lower tube of the frame; the muffler is just below this tube; the spark coil is on the upright post; and the tank is over the rear wheel. The machine is controlled entirely by the lever of the plunger brake. Pushing this down speeds up the motor, and pulling it up slows it down and applies the brake. The inlet valve stem and spring is exposed. Both inlet and exhaust valves can be readily removed.



ECLAIR'S SOMERSAULT MONOCYCLE COURSE.

MR. ECLAIR IN HIS WHEEL.

SOMERSAULT MONOCYCLE COURSE.

In the present era of "weak nerves," the performance of "looping the loop," in which a cyclist traverses a vertically placed loop, has quickly staled, and has now been

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relegated to the rear and supplanted by a still more sensational piece of daring, a modification of the former, but requiring even greater courage and fearlessness.

The inventor or originator of this new kind of "looping the loop," Mr. Eclair, also whirls through a looped course beginning 14 meters above the ground, forming a loop about 8 meters high and broad, and ending on the ground. The construction used by Mr. Eclair for training is shown in our illustration. The intrepid performer will shortly exhibit his marvelous feat at one of the Berlin circuses. The somersault monocycle course, as it is called by the originator, is not traversed by Mr. Eclair with a bicycle, but with a large iron ring, in which he stands upright, as shown in our picture. The iron wheel has a diameter of 2 meters, a width of 40 centimeters, and weighs 5 hundredweight. Mr. Eclair starts with this wheel from the point of departure, 14 meters high, and is thus whirled through the course. When the heavy wheel has spun down the incline, it strikes with terrific force a door closing the loop below, which flies open, and is thus impelled on through the door by the powerful force or momentum it has attained in its downward course. Upon its second arrival below, the iron wheel pushes open another door at the other extremity of the ring or loop, and then rolls out, the daring ride ending in a net.

As the course, which has a total length of 60 meters, is covered by the wheel in 8 seconds, and the performer has to turn in it 14 times like the spokes of a wagon wheel, we may be sure that the blood of the reckless rider is well shaken up. As a matter of fact Mr. Eclair began training by having himself shut up in a drum, which he had turned around, first slowly, then faster and faster. Notwithstanding this precaution, many little veins in Mr. Eclair's eyes have burst.—Translated from Für Alle Welt.

Details of the Allan Turbine-propelled Atlantic Liner.

BY THE ENGLISH CORRESPONDENT OF THE SCIENTIFIC AMERICAN.

The construction of the turbine-propelled Atlantic liner the "Victorian," is now well advanced, in the shipbuilding yard of Messrs. Workman, Clark & Co., Limited, of Belfast, Ireland, and she will be launched in the course of the next two or three months.

The vessel will have three propellers. The turbine engines have been designed with a special regard to the important question of reversing. They are to be constructed at the Belfast works of Messrs. Workman, Clark & Co., Limited, instead of at the Parsons works. Special care is being taken that the workmanship shall be of the highest class, the boiler power ample, and the pumps, valves, condensers, and other allied parts specially adapted to their work.

The "Victorian" will have accommodation for 1,500 passengers. She will be divided by bulkheads into eleven compartments, and these, together with the subdivisions of the double bottom, allow her to have twenty distinct water-tight spaces. She is built to the highest class of the British Corporation Registry of Shipping, and the strength of the hull has been greatly augmented over their requirements in order to meet the heavy weather of the North Atlantic.

Owing to the smaller size of the turbines, as compared with the ordinary reciprocating machinery, and consequently the less space occupied by the same, the freight space available is, notwithstanding the large complement of passengers, ample for the stowage of upward of 8,000 tons of deadweight cargo, and the facilities for its rapid handling and discharge are of the most up-to-date and efficient nature. Four large derricks are arranged on each mast, the lifting capacity of each being up to seven tons. These, together with two crane-post derricks, make ten in all, for the working of which ten double cylinder steam winches are supplied. Special attention has been given to the arrangement of the cargo holds, and the ordinary round pillar supports for the decks have been largely discarded in favor of special girders and supports, which leaves the holds freer for the reception, stowage, and discharge of freight. Insulated chambers for the carriage of fruit and dairy produce from Canada are provided in conjunction with refrigerating plant. The vessel has also sufficient coal bunker accommodations for the double journey, with an extra allowance for several days in the event of any unforeseen delay, thus obviating all fear of a shortage of fuel.

Wages of Farm Labor in the United States.

Within the memory of living men the standards of wages at the time current have been unsettled throughout the country on at least three memorable occasions. The discovery of gold in California in 1849, as a sequel to the war with Mexico, brought a revolution in prices. The civil war, 1861-65, withdrew millions of men from ordinary pursuits and left labor systems to be replaced under rates inflated by a disturbed currency. The war with Spain, 1898, with its temporary diversion of labor and its territorial expansion, has been too recent for its effect to be fully measured. Besides these influences, the coincident developments of steam and electricity, as applied to manufactures and transportation, have so diversified and intensified and specialized all forms of labor that farm labor is no longer a distinctive term. Agricultural labor can no longer be discussed intelligently without special treatment of the peculiar forms into which it has become separated by conditions of soil, climate, and distance from dense bodies of population. All this emphasizes the imperative need of education and training for the work of the modern farm, whether in the field with grain, stock, cotton, fruit, dairy and garden product, or in the house.

Correspondence.

A Laboratory Blowpipe.

To the Editor of the SCIENTIFIC AMERICAN:

In your issue of last week you describe a "laboratory blowpipe" for gasoline, which I think, from my experience with gasoline, would be a highly dangerous apparatus. In it the air is pumped into a gasoline tank, which it enters at the bottom and bubbles up through the gasoline, thereby becoming charged with gas (vapor) which is then led through a pipe from the top of the tank, and ignited at the open end, after a further admixture of air near the exit (which air may not be required) in order to produce the blue flame. Now, this apparatus will work all right as long as the resulting vapor from the tank, or in the tank, is sufficiently overcharged; but if the vapor falls to the point where air is present to form the explosive mixture, what will prevent its firing back to the tank, and exploding the same? I have handled numerous gasoline pressure lamps, stoves, blowpipes, and run a gasoline engine, but could not be induced to work with the rig described in your paper last week. Perhaps your readers would be interested with a little experiment I tried on my 1½-horsepower gasoline engine. I removed the carbonating valve, and built a tank similar to your generator described, running the inlet pipe from my engine to top of tank, and plugging top of tank with a seated valve, through which a ¼-inch gas pipe extended nearly to the bottom of gasoline, and putting a small air cock on engine inlet pipe to supply air for forming the proper mixture. Now I find in practice that while air is usually needed to form the explosive mixture, sometimes the mixture is of the right quality as it comes from the tank; and the air cock must be kept closed, which means that there is an explosive mixture in the tank. Now, in addition to the engine inlet valve, I have an additional check valve midway between engine and tank, so that if engine inlet failed to seat, the other valve would prevent firing back to tank, and in addition, my tank is made of 7-inch iron pipe, strong enough to withstand the pressure if a back fire happened. I might add that I have used the rig about six months, and it gives better results than the carbonating valve.

In conclusion, would state that I might lay a claim to being the youngest old subscriber of your excellent paper. I am thirty-five, and have read your paper about twenty-eight years. My father subscribed when I was a child, and when he finally gave it up, I continued to buy your paper up to the present, and would as soon do without my dinner on Saturday as miss it.

Toronto, January 18, 1904. A. C. L.

Protection Against Fire in Theaters.

To the Editor of the SCIENTIFIC AMERICAN:

I read with interest the articles on "The Theater Fire and Its Prevention in Germany," by Carl Lautenschlaeger, in your issue of January 23, 1904. In two respects, I think the apparatus therein mentioned has been very decidedly improved upon:

1. The recommendation of a sprinkling apparatus operated or controlled by valves, which in turn are worked by hand, is utterly out of date. If there was a scenery fire on the stage, it might easily be that no fireman could reach the valves. The automatic sprinkler, which will release and spray water whenever and wherever the temperature rises above a fixed limit (usually 155 deg. F.) is incomparably better.

2. The writer remarks: "It is essential that when a fire does occur, the gases be allowed to float upward in a strong draft. At the Prinz Regent Theater, previously referred to, this end is attained by huge ventilators, located at the very top of the stage, over the gridiron. They are controlled by manila ropes operated by the firemen from the stage floor. Even if they should not be lowered by the firemen, they would drop of their own accord upon the burning of the ropes."

An arrangement of an automatic character very much superior to that above described is being installed in a local theater. It consists essentially in a large skylight, the top of which is closed by doors, which would swing open from the leverage of weights placed at right angles to their surface, unless held down by a rope. The rope is fastened on a ceiling joist below on a hook, and between this hook and skylight doors is a fusible link, which will part when the temperature exceeds 155 degrees, thus causing the doors of the skylight to swing open, allowing the flames and gases to escape without getting into the auditorium.

If the stage is so broad as to render it desirable, the rope can be swung from pulleys to both sides of the stage, and fusible links inserted at several points, so that if there is a fire anywhere on the stage, it will at once release the doors.

Although the scenery employed in a theater is necessarily combustible, it will not make a fire lasting any great length of time, and if the heat is sucked out of the building by a strong draft created in the manner described, it is confidently believed that an audience might sit still in their seats, and be in no more danger than when sitting before an open-grate fire, to which the stage and proscenium arch would bear a strong likeness.

Many of the theaters use ventilators over the stage, but in order to protect the house from the severe downward draft, these are usually kept closed with some kind of cloth, or even in a more substantial manner. The danger is therefore that these would be found unavailable in case of fire; and even under the most favorable circumstances, the draft which they afford would be much inferior to a great direct draft created by a space open to the sky.

The fusible link operates almost instantaneously, and can absolutely be depended upon, whereas the burning of the manila rope as described by Herr Lautenschlaeger necessarily occupies some considerable time, every second of which is of enormous value.

One of the minor advantages of this arrangement is that by detaching the rope from the hook, it can be ascertained with very little trouble whether the doors are working freely on the hinges, and are therefore in good condition for the purpose designed.

Too much importance cannot be given to making all these appliances automatic, instead of depending upon the class of help which must necessarily be employed for such purposes. C. S. ASHLEY.

Toledo, O., January 30, 1904.

[The automatic sprinkler which is set into operation by the melting of a fusible alloy, serves a useful purpose, and is in use in Germany as well as the United States for the protection of cellars, passageways, etc. The sprinkler described by Director Lautenschlaeger is intended to deluge the entire stage from the gridiron to the cellar, a distance which might easily be 125 feet. Now, supposing a fire started at the level of the stage, the heat would not be intense enough, for a few moments, to melt the plugs, and the result is that the fire gains great headway. Sprinklers of the type mentioned by our correspondent do not permit of as thorough inspection as the other type of sprinkler in use in Germany. To insure safety, *all* the cloths, whether let down to the stage, or supported above the proscenium arch, must be thoroughly wet. The sprinkler valves can be operated from the stage, the gridiron, and from the director's box in front of the curtain. The ventilators referred to by Director Lautenschlaeger can be operated from the stage and from in front of the curtain. The burning of the sustaining ropes is only an added precaution, comparable to our correspondent's fusible plugs. Automatic appliances in conjunction with regular inspections, and the presence of trained firemen who can operate the machinery instantaneously, would tend to make a serious theater fire a rarity. There is a vast field for invention in the theatrical line.—ED.]

Iron and Steel Industry of Belgium.

To the Editor of the SCIENTIFIC AMERICAN:

Your valuable publication comes at regular intervals and forms a highly interesting part of the reading files of this consulate. Your issue on iron and steel has been much read by the shippers having invoices legalized at this office, inasmuch as Liege is a manufacturing city of much importance, and has within its environs many steel and iron works. They are shipping their products of steel and iron throughout the world, and have established a pretty fair market in the United States for steel rails and structural bridge iron. Their principal markets, however, are in Europe and Central and South America. Liege, as you know, is also noted for its manufacture of guns and gun barrels. It is a manufacturing city as important as any in Europe of its size.

Should you desire any information whatever concerning the manufactures here, or should any of your readers desire information from my consular district, it will afford me pleasure to be of service. My ambition is to open a market here for American goods of all kinds; and if I can in any measure compass that commercial union, I will be more than repaid for any service rendered in connection therewith. Requests for information are welcome at this office, and I comply with the same as speedily as possible and to the best of my ability.

JAMES C. MCNALLY,
United States Consul.

Liege, Belgium, December 26, 1903.

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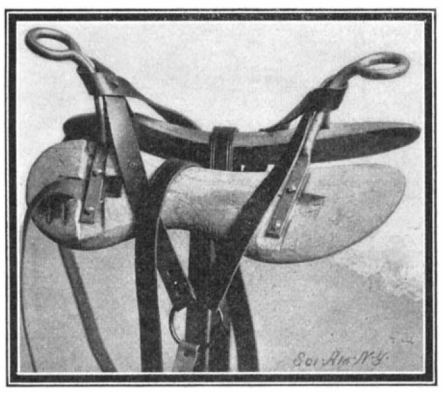
Patent Department

COMBINED PACK AND RIDING SADDLE.

The accompanying illustration shows an improved form of saddle which should be found very useful for prospecting purposes or for use in the army or for pack transportation of any kind. It combines all the advantages of a riding saddle with those of a pack



COMBINED PACK AND RIDING SADDLE.

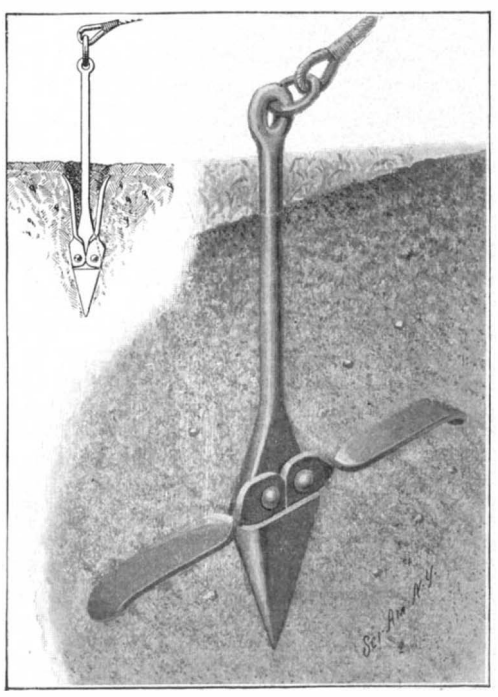
saddle, and the combination also affords other advantages not heretofore obtainable. The saddle consists of two opposing pads, preferably made of wood, which are spaced apart and placed at the customary angle to each other. The pads are held in position by means of two horns, the forward horn being practically the pommel of the saddle and the rear horn the cantle. These horns may each be made from one piece of round iron rod bent to the form shown in the illustration. The ends of these rods are flattened and fit against the pads, to which they are secured by screws.

Among the advantages urged for the improved saddle it may be stated that its superiority as an army saddle far outweighs its use as an ordinary pack saddle, as it is especially adapted for carrying the dead and wounded off the field, permitting the horse to be ridden back and enabling one man to do more of this work than at least four men on foot. The improved saddle is also well adapted for carrying light arms and ammunition to and from and on the field and light artillery through the mountains and on and off the field. A decided advantage is obtained by the use of the loop-knob for a horn, as it is easily grasped and held when mounting a fractious or bucking horse, and is particularly safe and advantageous where men mount upon the run and when horses are springing to their feet, having thrown themselves to dismount the rider.

The inventor of this combined pack and riding saddle is Mr. John T. Morgan, of Boise, Idaho.

LAND ANCHOR.

A recent invention provides an improved device adapted to secure to the ground a guy-rope, brace, or any similar form of supporting wire, and will be found particularly useful by telephone and telegraph linemen in place of the old style "dead man." The anchor comprises a central or main stem which, at the lower end, is enlarged, and is somewhat diamond shaped, with the free end tapering to a point, to facilitate driving the anchor into the ground. Two arms which are pivoted side by side to this head are each formed at the pivotal end with one edge round, concentric with the pivot, and the other left square. When

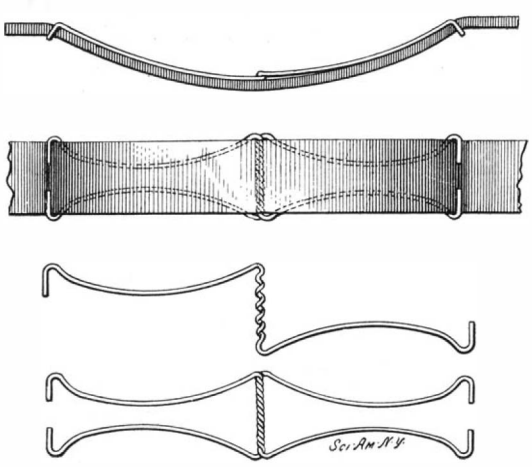


IMPROVED LAND ANCHOR.

the device is driven into the ground, these arms fold upward against the main stem and offer no obstruction, as they simply follow the hole made by the diamond-shaped head, the lower part of which is formed with an offset, which is in alignment with the pivotal portions of the arms. When the stem is drawn upward by the guy rope, the free ends of the arms will catch in the sides of the hole and diverge until they lie at right angles with the stem, when they are effectively prevented from swinging further by the squared edge of one arm engaging the corresponding edge of the other. Should either arm tend to swing downward before the other arm, it will be brought to rest in substantially the transverse position by engagement with the offset on the stem until the other arm is brought to the transverse position, and the squared shoulders are thus brought into engagement with each other. Heretofore in anchors of this type the strain has been made to come on an adjacent part of the support; but it will be seen that in this invention the strain on the arms is almost entirely taken by the supporting pivots, and not by the offset portion of the head. The pivot pins can be made of tough material such as steel, while the main stem can be made of cheaper material, such as wrought iron, that is best adapted to resist strain of the arms. The inventor of this land anchor is Mr. William G. Beach, care of James J. Hayes, Vicksburg, Miss.

SPRING DRAFT ATTACHMENT.

The value of a spring tension in a draft attachment has long been recognized as relieving the jar or jerk of the pulling strain on the horses' shoulders, and enabling the team to steadily strain with the load in starting, as well as to avoid damaging strains on the harness and vehicle. As long ago as July, 1880, a patent was issued covering an invention of this char-

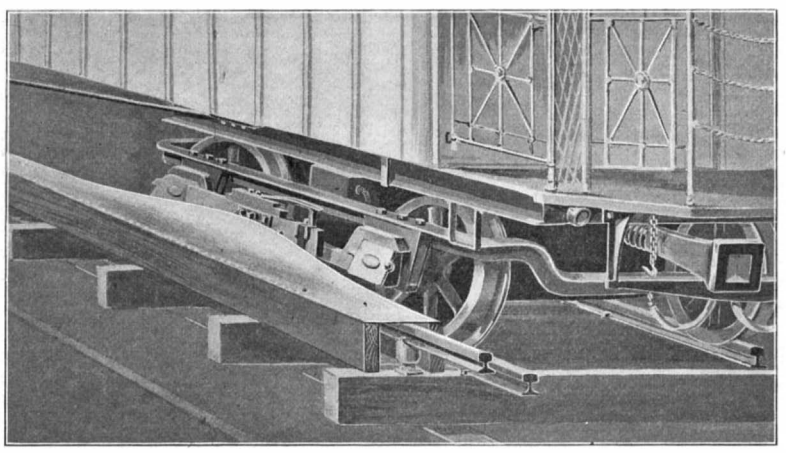


SPRING DRAFT ATTACHMENT.

acter. The invention comprises a bowed spring formed with eyelets or keepers at its ends, through which the trace was passed, so that the trace would lie upon the convex side of the bowed spring, and when the draft tension was applied to the trace, the trace would in straightening out flatten the bow spring, and thus maintain a tension in the draft attachment. Mr. George W. King, of 1325 Thirty-second Street, N. W., Washington, D. C., who invented this device, has just secured a patent on an improvement of the previous invention, which should bring the device into more general use. The improved attachment is so arranged that it will fit any size of trace, whereas the old attachment could not receive a trace that was wider than the eyelets, and a narrow trace would not occupy a middle position on the spring. Furthermore, it was difficult to thread a stiff trace through the eyelets, while in the improved form the attachment can be slipped into place without any trouble. The improved spring draft attachment, as clearly shown in the illustration, comprises two pieces of spring wire coiled about each other at the center, and formed at the ends with inwardly-projecting hooks. The device is applied laterally to the trace. The two arms at each end are sprung apart, and their hooked ends snapped over the edges of the trace. Owing to the spring pressure, these hooks will snugly fit over any width of trace and, moreover, the operation of applying the device to the trace, it will be readily seen, is very simple.

A NOVEL THIRD-RAIL PROTECTOR.

Winter time always brings with it a certain amount of difficulty for the third-rail railroad. Sleet, snow, and ice are only too apt to insulate the live rail so completely, that the contact shoes cannot perform their proper function of taking up the current. In summer time this difficulty naturally disappears. On the other hand, danger to human life is ever present. No matter how cautious the track walker may be, there is always the possibility of grave danger with a naked live rail in close proximity to the track. In New York city the elevated railroad officials have sought to overcome the obstacles occasioned by the formation of ice and snow by the employment of scrapers, which make a wintry night hideous with their noise. For the protection of human life, absolutely no means whatever have as yet been adopted.



NOVEL THIRD-RAIL PROTECTOR

To provide a guard for a third-rail, a guard which will protect the rail from sleet and snow, and which will likewise obviate danger to human life, is the purpose of an invention for which a patent has been granted to Mr. Jacob Martin, of 313 East 85th Street, New York city.

At the opposite sides of the rail are placed vertical guards which extend the full length of the rail and which are higher than the rail. To one of the rail-guards a supplemental guard or protector is secured which is composed of flexible material, such as canvas, canvas and rubber, or any other suitable material. The supplemental guard or protector is wide enough to cover the rail completely as well as the side guards, and whenever there is a curve in the track or whenever the rail is curved, the supplemental guard or protector is composed of sections, the guard or protector being divided transversely to form the section. One end of each of these separate sections is placed beneath the corresponding end of the next section. With the truck, a plow is connected which consists of a sheet of metal bent to represent one end of an ellipse. An opening is provided through which the contact shoe arms pass. The free end of the plow is bent downwardly at an abrupt angle, and the sides thereof are curved backwardly, and the end passes under the free edge of the flexible guard or protector.

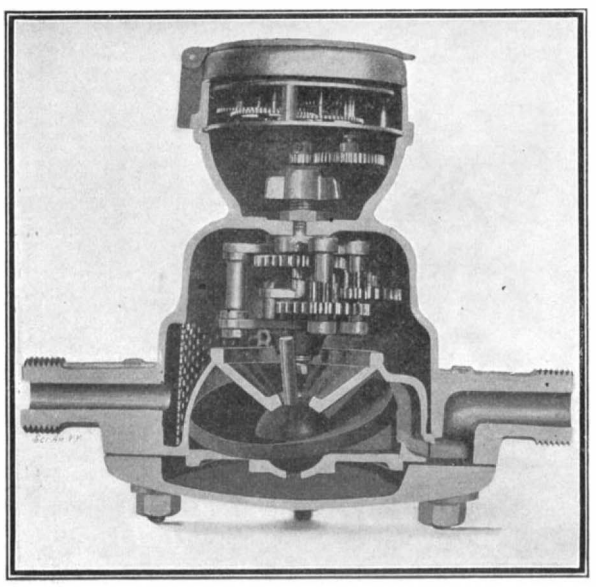
The free edge of the supplemental guard or protector is provided with a longitudinal strip of flexible metal, which is intended to give strength to the free edge of the flexible guard and to resist the friction and wear occasioned by the plow as it moves along.

Secured to the track near one end of the axles is an arm, having a foot-piece, which passes over the free edge of the supplemental guard or protector and serves to force it back into position after the shoe and plow have passed. This arm, however, is not essential.

As the car moves along the track the nose of the plow passes under the free edge of the flexible guard and raises it, and the shoe moves over the surface of the rail. As the car proceeds the free edge of the supplemental guard or protector drops into position and the rail is securely covered thereby at all times.

THE DISK TYPE OF WATER METER.

The design of a successful water meter is no simple task. The primary requisite, of course, is accuracy. At the same time this should not detract from the



THE DISK TYPE OF WATER METER.

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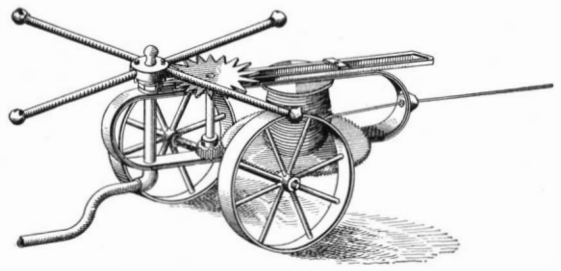
simplicity, durability, and low cost of construction, or the initial outlay for installation and subsequent expenses for repairs of the meter would overbalance the benefits which they would otherwise bring to the water supply company. The disk type of water meter has been found to fulfill these exactions more nearly than any other. This meter involves a mechanical motion which is very interesting. The principle was first applied to steam engines, and is said to have been invented in 1830. The invention was taken up by a number of persons, notably Bishop, an Englishman, who brought it more nearly to its present form. Although this mechanical movement is so old, we venture to say that few of our readers are familiar with it. The latest development of the invention is illustrated in section in the accompanying engraving. In this meter the water passes through a screened inlet at the left, enters the disk chamber through a port not shown in the illustration, and passing through this chamber flows out of the port shown at the right. In its passage through the chamber the water imparts to the disk a peculiar movement about its center, which may be described as a gyratory movement, with the exception that the disk does not rotate on its axis. The disk, it will be observed, is slightly dished, and at its center a ball is formed which finds bearings in the top and bottom walls of the disk chamber. The side walls of the chamber are curved so as to fit closely, but without friction, against the periphery of the disk throughout its entire cycle. The top and bottom walls are also so arranged as to provide a snug fit along the crest and trough respectively of the circular waves which the disk is constrained to describe. A vertical radial septum, formed at one side of the chamber, fits into a slit cut in the disk. This septum will be seen at the right, just back of the outlet port in our illustration, and serves to prevent the disk from rotating. It also separates the exhaust or outlet port from the inlet port, which opens into the chamber just behind the septum. A spindle projecting upward through a circular opening in the top wall of the cylinder, bears at its upper end against a conical block. This tips the disk to one side, so that its under surface at that side will come in contact with the bottom plate of the chamber, while the upper face on the opposite side will come in contact with the upper wall of the chamber. Now, by studying the illustration, it will be observed that the disk, no matter what its position, will at one point or another cut off the free passage between the inlet and outlet ports. With the disk in the position illustrated, water pours into the disk chamber against the under face of the disk, and as the water sweeps around the circular chamber in its course to the outlet port it exerts a forwardly-moving lifting or wedging force on the disk. The disk cannot be tipped to vertical position of its axis because of the conical control block against which the spindle bears. Therefore, it is constrained to follow the gyratory movement described above. That is, the upper end of the spindle describes a circle about the block while the upper and lower faces of the disk roll respectively along the top and bottom walls of the chamber. As the disk rolls around under the pressure of the water, its line of contact with the upper wall will pass the inlet port, whereupon water is admitted to the upper face of the disk, exerting a downward pressure thereon at points diametrically opposed to the upward pressure on the under surface of the disk and causing a continuous gyratory movement of the disk. The revolutions of the disk's spindle are communicated to the counter at the top of the meter through suitable step-down gearing. It will be observed that this form of mechanical movement is an ideal one for water meters, owing to its accuracy, and the simplicity of construction which it allows. The disk is made of hard rubber which has about the same specific gravity as water, and since the ball is exposed to the inlet pressure of the water through the openings in the top and bottom bearing sockets, a perfect water balance is secured, reducing wear to a minimum.

ODDITIES IN INVENTIONS.

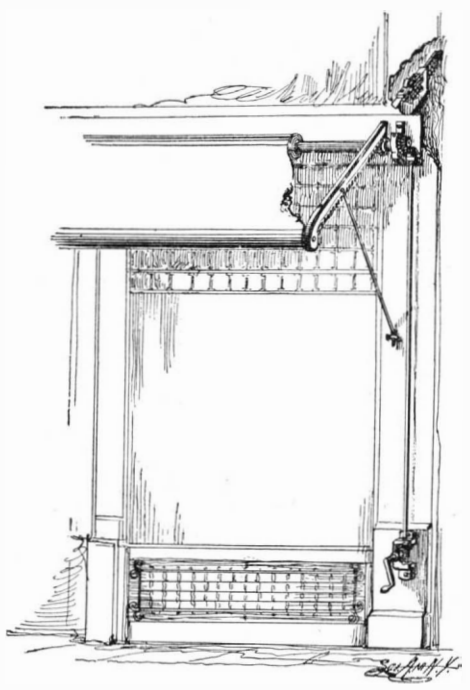
TRAVELING LAWN SPRINKLER.—In order to distribute water more generally over the entire lawn, a Minnesota inventor has devised a lawn sprinkler which is actuated by the pressure of the water to travel slowly over the lawn in any predetermined direction. The lawn sprinkler is mounted on wheels. The garden hose is coupled to a vertical pipe on the sprinkler. At the top of the pipe is a revoluble head provided with hollow radial arms formed with discharge nozzles at their ends set at an angle with the arms. Back pressure of the water on the arms in flowing out of the discharge nozzles tends to rotate the head in the usual manner. Pins on this head engage the teeth of a star wheel, which by means of suitable gearing communicates the motion to a reel at the front of the sprinkler. One end of the wire is fastened to this reel, and the other end is secured to a stake driven into the lawn at any desired point. As the reel rotates, this wire is coiled up, drawing the sprinkler forward. When the end of the wire is reached, a projecting plate on the sprinkler strikes the stake to which the wire is secured, and the plate is thus forced back. This motion is utilized to lift a small pinion out of mesh with the



TRAVELING LAWN SPRINKLER.

gearing mechanism, thus stopping the rotation of the reel. By varying the number of pins in the revoluble head of the sprinkler, its rate of travel over the lawn may be controlled.

AN IMPROVED AWNING.—The present slow and cumbersome manner of handling awnings has suggested to a Californian the need of an improved construction. The arrangement which he has devised is illustrated herewith, and may be described as follows: The awning frame comprises two bars, which project from openings in the wall of the building, where guides are provided to receive them. The projecting ends of the bars are connected by a cross bar, and stretched from this to a shaft or roller mounted above the door or window which is to be screened, is the fabric of the awning. The awning may be rolled up by means of



AN IMPROVED AWNING.

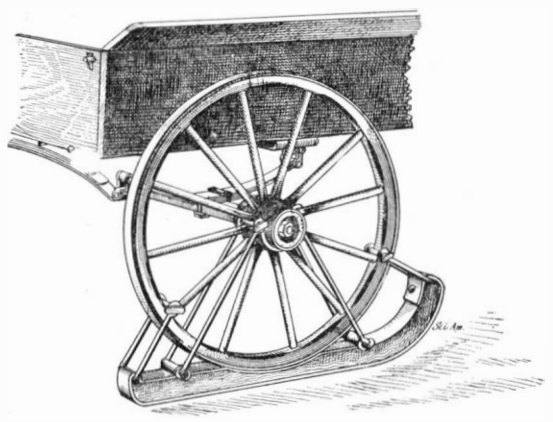
a crank lying within easy reach of the operator, and connected by suitable gearing with the roller. Each side bar of the awning frame is formed with a rack on its lower edge, and these racks are adapted to mesh with pinions on the roller, so that when the crank is operated, the bars are fed back in the openings in the wall, causing the awning to be evenly rolled up on the roller. The additional brace for the side bars, which is shown in our illustration, is not ordinarily necessary, but will be found useful under certain circumstances.

SHAVING MUG.—A Yankee inventor has devised a shaving mug, which is provided with a simple means for holding the cake of shaving soap normally out of contact with the water, but in such manner that it may readily be dipped into the water when desired.

IMPROVED SHAVING MUG.

The cake of soap rests on a perforated plate, which is supported by coiled springs extending upward from the bottom of the mug. The side wall of the mug extends somewhat below the bottom, and fits snugly into a pan, thereby forming a closed chamber. Two ports in the bottom of the shaving mug open into the chamber, but are normally closed by valve plates controlled by a rod extending outward through the wall of the cup. The valves are opened when it is desired to clean the mug, fresh water being poured in at the top until the parts are thoroughly clean. In use, when it is desired to dampen or wet the soap, it may be forced downward into the water by pressure of the lather brush and, of course, upon releasing this pressure, the coil springs will move the soap upward out of the water.

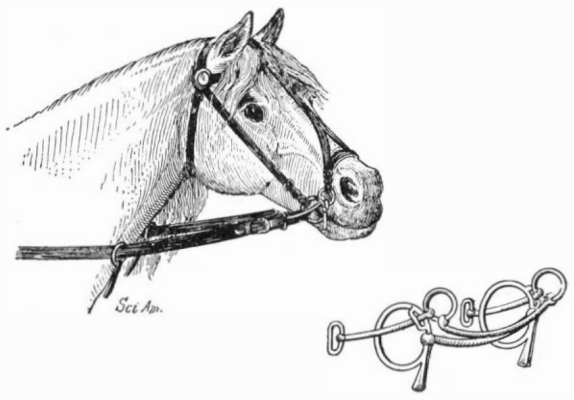
DETACHABLE SLEIGH-RUNNER.—In territories where the winter season brings only occasional snows it will be found very useful to have on hand a set of detachable sleigh-runners which can readily be applied to the wheels of a wagon, thus converting it tempor-



DETACHABLE SLEIGH RUNNER.

arily into a sleigh. Such an attachment we show herewith. It will be observed that the runner can be applied in an instant. The wheel is drawn up onto the runner and seated in a hollow therein. The runner is provided with hinged braces which are swung up against the wheel and secured by bolts passing through eyes formed in the ends of the braces. The bolts pass over spokes of the wheels and thus rigidly secure the wheel to the runner. Key-bolts are used instead of the usual threaded bolts. By this arrangement a driver can in a very short space of time convert his wagon into a sleigh without requiring any tools other than a hammer or bar with which to drive the keys in place.

BRIDLE BIT.—The accompanying illustration shows a bridle bit which may be used on such animals as have tender mouths or the reverse, and it affords means for the control of the animal in case it becomes fractious, which, however, will ordinarily serve to guide an animal without hurting the mouth. The improved bit really consists of two bits so connected that by a gentle pull on the lines the horse may be guided as usual, but when necessary hard pulling upon the bit will bring into service the check bit, which will put a severe strain on the animal's mouth and arrest the attempt to run away before injury is done to the ani-



COMBINATION DRIVING AND CHECK BIT.

mal or driver. A very advantageous feature of the improved bit consists in the safety afforded in case of the accidental breakage of the jointed driving-bit, as the check-bit will remain in the mouth of the animal and enable the driver to control the animal, which otherwise would be released from control if the two separate bits, both connected with the driving-lines, were not employed. The inventor of this combination driving and check bit is Mr. William T. Temple, of Trenton, N. J.

A single telegraph company has long enjoyed the monopoly of making the connections between the fire stations of the great English metropolis, and their demand made recently for a proposed connection of this character was regarded as exorbitant by the city officials, who circumvented the telegraph company by installing the Marconi system between the two points. This was done as an experiment, and was soon found to be so satisfactory that it will be extended, and it is proposed now to install instruments on some of the apparatus, so that the fire department officials on the fire grounds may be in direct and constant communication with those at headquarters.

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RECENTLY PATENTED INVENTIONS.

Apparatus for Special Purposes.

CONCENTRATOR.—H. WISMEYER, Emporia, Kan. This apparatus is adapted for use with any machine in which a blast is produced capable of carrying over the fine gold and foreign substances with which it is mechanically mixed. The material thus carried is received into the distributing chamber, whence it descends into conductors permeable to air, and which permit escape of the air proper, while detaining gold and foreign substances, which are both conveyed into a separator and grader having compartments and pockets in which final concentration is effected, the products graded according to quality and value.

COMBINED GOLD SEPARATOR AND AMALGAMATOR.—H. WISMEYER, Emporia, Kan. Free gold is ordinarily found associated with heavy black sand or sand and iron, the greater portion of the gold being in the form of thin light scales. In treating such material by means of the ordinary processes or machines much of the flour or float gold is lost, whereas it is chiefly separated and saved by Mr. Wismeyer's machine, it being carried off by a strong air-current, while heavier particles of gold are received upon and saved by amalgamating-plates.

Electrical Devices.

ELECTRIC BLANKET.—F. K. SINGER, Wheeling, W. Va. Mr. Singer's invention refers to that class of blankets, towels, pads, etc., which have incorporated in their texture extended circuit-wires disposed in more or less tortuous paths and which are designed to receive a current of electricity to produce, by resistance of the wire, heating effects or to produce electro-inductive effects and to be applied to the body for therapeutic use in disease.

PRINTING-TELEGRAPH RECEIVER.—J. D. WHITE, 50 Clanricarde Gardens, London, England. The objects of this invention are to provide a receiver of the same general character as described in a former patent granted to this inventor, but so contrived that as compared with that other the range of characters is doubled without increasing the amount of the step-by-step movement, so that the same amount of step-by-step movement, which in that other case is utilized to give a range of characters ("letters") is in this utilized to give that same range of characters of one class ("letters") and also a range of characters of another class ("figures"). Means are provided for printing from either class continuously and for shifting from either to the other.

Engineering Improvements.

MIXER FOR GASOLENE-ENGINES.—J. M. JOHANSON, Cambridge, Mass. In this case the invention relates to improvements for gasolene-engines; and one object in view is the provision of means by which a hydrocarbon fuel is atomized and ultimately mixed with air to produce a combustible mixture adapted to produce an explosive charge when admitted to the piston cylinder.

VALVE-GEAR FOR EXPLOSIVE-ENGINES.—J. M. JOHANSON, Cambridge, Mass. The principal object of the invention is to provide means by which the valve may be allowed to open outward as contradistinguished from inward against the cylinder-pressure and which means, while permitting this outward movement, will nevertheless hold the valve seated with absolute firmness during the expansive period of the cycle. An object is to avoid backlash on the gearing of the cam-shaft and to prevent the operation of the valve from materially loading the shaft and connected parts.

TUNNEL CONSTRUCTION.—J. L. HOLMES, Butte, Mont. In this patent the invention has reference to improvements in the construction of tunnels across rivers or the like, an object being to provide a novel tunnel construction by means of which the work of laying a submarine tunnel may be rapidly and safely carried on to completion.

ROTARY VALVE.—R. GILLETTE, Littlefalls, Minn. The invention relates to rotary valves used more particularly for the steam-feeds of saw mills and analogous devices. An important feature is that live steam when fed through the live-steam ports is made to enter the revoluble plug by distinct and independent routes. Where ports are in communication with each other by a saddle-shaped channel, as is sometimes the case, the walls of the casing are liable to spring and bind upon the plug, owing to excessive pressure of steam. Valves cannot be well balanced except by feeding the steam through distinct passages to different sides of the plug.

Household Utilities.

TELESCOPIC COUCH-BED.—W. THOMPSON, New York, N. Y. The bed is a composite structure and practically consists of two smaller beds, one of which may be telescoped into the other, so that the two form a composite bed which when extended is nearly double the width of the smaller beds, but which when in use is telescoped, so as to occupy practically only the space of a single small bed. The members may be readily dismantled and made into separate couches.

SUPPORT OR HOLDER FOR NURSING-BOTTLES.—J. D. WHITE, Philadelphia, Pa. The object in this case is to provide a device which will afford a simple, convenient, and reliable support for a nursing-bottle that may be connected with the body of a baby-coach or other stable support or be engaged with a movable pedestal that is of sufficient weight to maintain the holder and bottle at any desired point for feeding an infant.

EXTENSION-TABLE.—T. C. THOMPSON, Haley, Tenn. In carrying out the present invention Mr. Thompson has in view so constructing his table that it will be composed of few parts and will have extremely simple means for adding to the area of the table-top-supporting frame for the reception of supplemental leaves. The frame which supports the table top is so constructed that the placing of a leg at each corner of the table-top frame is obviated.

Machines and Mechanical Devices.

MOTOR-OPERATED HAND-TOOL.—A. W. CLARKE, New York, N. Y. The principal feature of the invention lies in the provision of a motor-fluid reservoir forming part of the tool, so that when the reservoir is charged the motor may be driven by the fluid in the reservoir for a certain length of time, depending upon the reservoir capacity, without any connection with a reservoir separate from the tool. It is particularly useful in dental work.

VENDING-MACHINE.—W. FORSYTHE, Tama, Iowa. An object in view in this case is the provision of a mechanism for vending lead-pencils and objects of a similar nature, the mechanism being normally and securely locked and adapted when released by the deposit of a coin to be easily operated by an exposed part so as to discharge a pencil or its equivalent. It can only be actuated by the deposit of a coin or slug of the proper weight and size.

MECHANICAL MOVEMENT.—J. TAGLIAFERRI, New York, N. Y. The intention in this instance is to provide a movement more especially designed for converting rotary motion into rectilinear reciprocating motion, or vice versa, and in such a manner that dead-center positions are avoided, a greater movement is produced in a smaller space, a uniform speed given to the members, and the power transmitted to the fullest advantage.

MECHANICAL MOVEMENT.—A LINDSAY and J. MEINERT, Davenport, Iowa. In carrying out this improvement the inventors have particularly in view as an object the provision of a mechanism designed for imparting power to the dasher-shaft of churns and to washing-machines and the like. It may be used to impart rotary reciprocating movement to a vertical shaft, the power being taken from a rotating approximately horizontal shaft.

FLESHING AND SHAVING MACHINE.—E. SCHROEDER, New York, N. Y. This invention relates to fleshing and shaving machines such as shown and described in a former Letters Patent granted to Mr. Schroeder. The object in the present instance is to provide a machine very effective in quickly and accurately removing the surplus flesh from the under side of raw furs or for paring or shaving the under side of dressed furs or skins to reduce the same to a uniform thickness.

ROTARY PLEASURE-TOWER.—W. R. SNYDER, Kimberton, Pa. While the tower rotates the carriages moving up and down the inclined parallel guideways travel a vertical spiral course, permitting passengers to view surroundings while in transit, and the revolving swings will travel a horizontal spiral course. The lookout house at the top of the tower rotates with the tower, allowing a fine view without change of position to passengers. There are four elevating-carriages, one each side of the tower, and while two ascend two will descend. They hold two or more persons. Three upright posts at each corner may be used if found strong enough for the height of tower erected; further, the iron used in upright posts and braces may be of any form, tubular or angles.

Of Interest to Farmers.

HARROW OR CULTIVATOR TOOTH.—J. Y. COOPER, Nashville, Tenn. The aim of this invention is to provide a tooth of novel construction which adapts the tooth for convenient attachment upon a frame-beam of a harrow or the frame of a cultivator and prevents the tooth from moving in any direction, but permits it to be readily detached, a further aim being to provide the improved features for a double-pointed tooth, so as to allow the tooth to be reversed in position and substitute a sharp end of the tooth for one worn out.

BAND-CUTTER AND FEEDER FOR THRESHING-MACHINES.—C. CHRISTIANSEN, Crookston, Minn. The purpose of the invention is to provide a simple construction of band-cutter which will positively separate the bands of all bundles presented to the cutters, and, further to provide shakers acting in conjunction with the bundle-carrier which will thoroughly shake the bundles and spread the straw before delivered to the cylinder and concave.

Pertaining to Vehicles.

MOTOR-WHEEL FOR VEHICLES.—J. W. WALTERS, New York, N. Y. The object of the present invention is to supply certain improvements in motor-wheels for vehicles whereby the operating mechanism is greatly simplified to insure a quick handling of the vehicle by the operator when starting or stopping the motor, as well as when propelling and steering the vehicle. The invention relates to motor-wheels described in two former Letters Patent granted Mr. Walters.

VEHICLE-BRAKE.—J. FERREL, Dec'd, J. F. REYNOLDS, administrator, Zanesville, Ohio. In some of its features this invention is specially adapted for use on spring-vehicles, one of its objects being to hold the brake-shoes in invariable radial distances from the centers or axles of the wheels with which they co-operate irrespective of the position the body of the vehicle may occupy in relation to the axles by reason of the yielding of the springs due to variations in load, to jolts, etc.

Railways and Their Accessories.

PIPE-JOINT.—D. P. FAHRNEY, G. A. NEWTON, and F. F. SIMMONS, Springfield, Mo. This invention relates to improvements in joints for air or steam pipes of car-brake systems or other train-pipes, an object being to provide a joint of simple construction for connecting pipes between cars, doing away with the usual hose-couplings and overcoming the objectionable slack and vibration of such couplings. As to leakage, the joint is absolutely air or steam tight.

FUSEE.—E. KERN, Stuttgart, Kan. In this patent the invention refers to an improvement in a fusee in which three wires, fine but strong, extend vertically the whole length of the fusee, the object being to prevent the fusee from breaking when thrown from a moving train for the purpose of sticking in the ties or roadbed. The object is attained by means of the three wires attached to and made a part of the fusee.

RAILWAY-SWITCH.—W. L. WILLIAMS, Jeffersonville, Ga. In this instance the invention has reference to improvements in railway-switches, Mr. Williams having for his object the provision of a switch mechanism of simple and durable construction having no parts in any way liable to get out of order and that may be operated from a moving train.

CAR-BUFFER.—G. F. STARBUCK, Waltham, Mass. In carrying out this improvement the inventor has especially in contemplation as objects, first, the decrease in wear; second, prevention of change of form due to wear, and, third, consequent to the preceding, the avoidance of unnecessary stresses due to the improper forms of the rubbing-surfaces. It has particular application to a buffer-attachment for use between the locomotives and tenders of trains.

Miscellaneous.

IDENTIFICATION-CARD.—B. L. BEHRENDT, New York, N. Y. The invention pertains to cards provided with the portrait and autograph of the owner for identifying purposes; and its object is to provide an identification-card arranged to enable postal authorities, bankers, and others to immediately and correctly identify the holder of the card and to prevent fraudulent alteration of the card.

COAT.—C. AUSTERN, New York, N. Y. The principal object here is to provide a coat the main portion of which may be cut in one piece from a bolt of cloth material, the front edges of the garment being formed integral with the main body of the coat, thus obviating the necessity of cutting additional strips and sewing them to the coat, and also possessing the advantage that such integral front edges will not offer a chance for dust or the like to accumulate in the garment by ripping of stitches.

METHOD OF ELEVATING LIQUIDS FROM WELLS.—T. F. MORAN, DeYoung, Pa., and F. J. MOSER, Kane, Pa. The improvement of these inventors relates to the elevating of liquids from deep wells, and especially to such as are used in the oil regions. In certain oil fields where the wells have been drilled—say fifteen years—many become exhausted of their gas pressure, and the liquid has not the tendency to rise to a height to enable it to be readily elevated. The method involved in their present application constitutes a remedy for the shallowness of the liquid in the wells referred to in order that the liquid may be readily raised by air.

LIFTING-JACK.—L. O. LANDER, Lisabuela, Wash. One of the principal objects in the present invention is to provide means for overcoming disadvantages found to exist in jacks of this kind, and also to provide a jack simple in construction, not liable to get out of order, and which is inexpensive to manufacture. It has a capacity of long and continued service. The improvement has reference more especially to the type of lifting jacks of which the one shown and described in a former Letters Patent granted to Mr. Lander is an example.

LOGGING DEVICE.—G. MOORE, Monroe, Wash. The object of the invention is to provide a new and improved logging device more especially designed for running logs down steep grades such as the steepest parts of a chute or skid-road under perfect control of the operator and without danger of injuring the logs while dashing with great velocity.

NOTE.—Copies of any of these patents will be furnished by Munn & Co. for ten cents each. Please state the name of the patentee, title of the invention, and date of this paper.

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READ THIS COLUMN CAREFULLY.—You will find inquiries for certain classes of articles numbered in consecutive order. If you manufacture these goods write us at once and we will send you the name and address of the party desiring the information. **In every case it is necessary to give the number of the inquiry.**

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For mining engines. J. S. Mundy, Newark, N. J.

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Handle & Spoke Mchy. Ober Mfg. Co., 10 Bell St., Chagrin Falls, O.

Inquiry No. 5121.—For makers of clock time recorders.

Sawmill machinery and outfits manufactured by the Lane Mfg. Co., Box 13, Montpelier, Vt.

Inquiry No. 5122.—For machines for grinding scissors.

American inventions negotiated in Europe. Felix Hamburger, Equitable Building, Berlin, Germany.

Inquiry No. 5123.—For nib and steel pen-making machines.

Non-refillable bottle. Simple, practical and non-refillable. Address R. T. McKenzie, Spring Hill, Miss.

Inquiry No. 5124.—For a dynamo and engine complete for a small plant, for furnishing current for private residence.

Gear Cutting of every description accurately done. The Garvin Machine Co., 149 Varick, cor. Spring Sts., N. Y.

Inquiry No. 5125.—For manufacturers of corn huskers.

Edmonds-Metzel Mfg. Co., Chicago. Contract manufacturers of hardware specialties, dies, stampings, etc.

Inquiry No. 5126.—For manufacturers of fire extinguishers.

Empire Brass Works, 106 E. 129th Street, New York. N. Y., have exceptional facilities for manufacuring any article requiring machine shop and plating room.

Inquiry No. 5127.—For small steam engine for operating a dynamo giving 8 to 12 volts and 1 to 2 amperes, for experimental purposes.

The largest manufacturer in the world of merry-go-rounds, shooting galleries and hand organs. For prices and terms write to C. W. Parker, Abilene, Kan.

Inquiry No. 5128.—For dealers in loom supplies, such as reeds, shuttles, etc.

The celebrated "Hornsby-Akroyd" Patent Safety Oil Engine is built by the De La Vergne Refrigerating Machine Company. Foot of East 138th Street, New York.

Inquiry No. 5129.—For dealers in shoddy mill, excelsior machine, wire mattress machine and mattress wire.

Manufacturers of patent articles, dies, metal stamping, screw machine work, hardware specialties, machinery and tools. Quadriga Manufacturing Company, 18 South Canal Street, Chicago.

Inquiry No. 5130.—For manufacturers of tin shingles.

Non-union millwright, competent to do drafting, laying out work and installing machinery, wishes position with parties about to build. Country job preferred. Address Box 32, Ludlow, Vt.

Inquiry No. 5131.—For machinery or complete installations for producing iron from the ore.

Wanted—Revolutionary Documents, Autograph Letters, Journals, Prints, Washington Portraits, Early American Illustrated Magazines, Early Patents signed by Presidents of the United States. Valentine's Manuals of the early 40's. Correspondence solicited. Address C. A. M., Box 773, New York.

Inquiry No. 5132.—For manufacturers of all kinds of brushes.

WANTED.—Manufacturers to negotiate for manufacturing King's Steel Wire Spring Draft Tug. See illustration and description in this number of the SCIENTIFIC AMERICAN. Geo. W. King, 1325 32d St., N. W., Washington, D. C.

Inquiry No. 5133.—For makers of steel hooks and eyes for clothing.

An estate, holding a controlling interest in a corporation manufacturing patent devices for use in the equipment of power plants, will sell its entire holdings to enable it to adjust estate matters. An excellent opportunity for any one who can take an active part in the management of the company. Not over $15,000 necessary. Full particulars furnished and no names of inquirers disclosed. Elliott, Box 773, New York.

Inquiry No. 5134.—For makers of sheet metal novelties, also rule made of celluloid, aluminium or other suitable material.

Inquiry No. 5135.—For lace and net-making making machines for making torchon insertions, crochet laces and mosquito netting.

Inquiry No. 5136.—Wanted, to purchase patents on articles suitable for general consumption, such as novelties, etc.

Inquiry No. 5137.—For manufacturers of concaving machines.

Inquiry No. 5138.—For catalogues and prices of novelties.

Inquiry No. 5139.—For makers of hot air engines for running light machinery.

Inquiry No. 5140.—For a small dynamo that can be attached to faucet and give current enough for a tank that holds about 20 gallons.

Inquiry No. 5141.—For machinery for making paper plates, butter dishes, oyster pails, etc.

Inquiry No. 5142.—For manufacturers of stove polishing mitten and dauber.

Inquiry No. 5143.—For Spanish and English catalogues of furniture.

Inquiry No. 5144.—For makers of cabinet boxes of fancy hardwoods, size about 6 x 6 x 9 inches, by the thousand.

Inquiry No. 5145.—For printers, or knowledge of how to print views or pictures on fancy wooden boxes.

Inquiry No. 5146.—For catalogues of auctioneer goods, as a specialty.

Inquiry No. 5147.—For manufacturers of oscillating engines ranging from ⅛ h. p.

Inquiry No. 5148.—For makers of ¾-inch 22 gun brass tubing.

Inquiry No. 5149.—For addresses of pipe organ builders, organ pipe makers and makers of organ action, tracker, pneumatic bellows, etc.

Inquiry No. 5150.—For Canadian manufacturers of power transmitting machinery.

Inquiry No. 5151.—For makers of Baxter lamps, such as wind like clocks.

Inquiry No. 5152.—For castings for a motor cycle.

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HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

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(9316) A. F. S. writes: I am a constant reader of your valuable paper, but to my memory I have not noticed anyone discussing the philosophy of cloud electricity. I believe the matter is a problem in most minds, and deserves attention. For example, why is it that lightning is rarely seen in the winter, and only occasionally in the summer? How is the energy accumulated? Here is what I have to say from observation. Witnessing some approaching storms in the summer, it could be observed that there was some difference as to the behavior of the clouds and their formation. If the latter appeared as a great dense blanket, though very threatening to the eye, and great gusts of wind preceding it, there was no violent effect either as lightning or rain. When these clouds would break up by hot and cold air disturbances, or if the storm appeared broken up, often one cloud above the other, there was much electrical display, as well as rain. These cloud bodies did not move uniformly; when the confusion was slight, there was chain lightning and no rain; when it was greater, great bolts shot into the earth, often followed by torrents of rain, probably due to the sudden cohesion of the water particles. Clouds, I should infer, are always electrified by wind friction, but their normal potential is continuous but low, so long as they move uniformly; when different divisions pass each other, magnetic induction is established, and great intensification of their charge results. I believe that cloud electricity is unlike that of our glass disk generator. It is water electricity as generated in boilers and the lungs, and is identical with vital energy, because its magnetism alone influences the living body. I wish to hear from others as to this; also how can a thunder-bolt splinter a wooden house and then drive a section of its foundation a half inch into the hard dry ground? The spark has no weight, but it takes many tons to duplicate such a feat. A. Your note concerning the electrification of the clouds and the action of lightning has points of interest, but we are not able to see any effect of magnetic induction in these phenomena; nor that lightning and the energy of a living being are identical. The mechanical force of lightning is by all considered to be due to the rending and beating of the air and its rushing back into the space from which the passage of the electric discharge has driven it out. These actions are not electrical any more than a boiler explosion is electrical.

(9317) S. T. C. says: I desire to know what amount (if any) of water may be carried off by dry air if some was forced into water and allowed to escape (through conducting pipes) some distance from the water. A. Saturated air at 72 deg. Fahr. contains 0.0012 pound of water per cubic foot, and by using ordinary dry air of 50 per cent moisture, 1,000 cubic feet of air will absorb and carry off 0.6 of a pound of water; and if the temperature of air and water is raised to 100 deg., about 1¼ pounds of water may be evaporated per 1,000 cubic feet of air. By raising the temperature of the water to 125 deg., 3½ pounds of water may be evaporated per 1,000 cubic feet of air.

(9318) L. H. asks: I have a 3-horse-power vehicle gasoline engine with electric igniter supplied by six No. 2 carbon porous cup cells and 9-inch plain spark coil. The ignition has never been satisfactory, and has given me no end of trouble, and as I cannot get satisfactory answer from the manufacturers of the engine, I want to get an expert's answer to a few questions. I think the electrodes are made of iron or steel. What do you think would be the best arrangement to supply a spark to this igniter? How could my battery as described above be improved to give best results? What kind of a spark coil would give the best spark, and how many cells would it require? Considering that I run my engine only a part of the time, and sometimes it stands idle for days, but when I do want to run it, it is important that it should go good, which is very uncertain as arranged now, would not an improved auto-sparker be a good thing for my engine? How much of the engine's power would the auto sparker require? A. A six-cell battery with a 9-inch spark coil should be faultless in electric power for operating a gasoline engine, if its individual parts are in proper condition. The system is largely in use and giving satisfaction. The other system with a jump spark is so different that it will require much change, such as a new plug, an induction coil, which may be used with the same battery, or by a small dynamo. We advise a thorough examination of the parts, beginning at the battery. See that the battery is cleaned and given a fresh charge, and test it by a break contact of the wires, then connect the coil and test it in the same way, which should give a brighter spark. Then take out the plug and thoroughly clean every part; take out the spindle, and remove any carbon or dirt that might cause a short circuit. Connect the plug with the battery and coil, and test the break spark by hand, and if there is still a fair spark, it should be in good order. Reconnect to the engine, and give it a final test trial. The contact points of the electrodes should be of platinum, and if not, and the faces are corroded, they may be of steel, and should be dressed smooth and slightly rounded for perfect contact. We apprehend that your complaint, which is not stated in detail, is due to short circuit of the current at the spark end of the plug by a deposit of carbon on the intervening surface between the electrodes. Frequent cleaning is needed in this as well as other sparking plugs. The auto-sparker, or jump spark system of ignition, is much in use and is very satisfactory. The power required to operate the auto-sparker is very small, probably not one-eighth of a horse power.

NEW BOOKS, ETC.

SIMPLE METHODS FOR TESTING PAINTERS' MATERIALS. By A. C. Wright, M.A., B.Sc. London: Scott, Greenwood & Co. New York: D. Van Nostrand & Co. 1903. 16mo. Pp. 163. Price $2.50.

The materials employed in painting are peculiarly liable to sophistication, and it is not uncommon to find one substance entirely replaced by another of lower value. This book is designed to enable the painter and dealer to test and value the materials they buy, and the manufacturer and dealer the samples submitted to them, in the simplest manner, both in regard to practical properties and composition.

THE HANDYMAN'S BOOK OF TOOLS, MATERIALS, AND PROCESSES EMPLOYED IN WOODWORKING. Edited by Paul M. Hasluck. London: M. D. Cassell & Co., Ltd. 8vo. 760 pages, 2,545 illustrations. Price $4.

The author is a well-known amateur mechanic who has added very largely to the literature of the subject. The author believes that the present volume is by far the most exhaustive book on the subject hitherto produced, and an examination of it would seem to confirm this view. While some of our tools are slightly different and are used differently here than in England, still the differences in practice do not render this book of little value to the American reader. It is a book which will delight the amateur mechanic, as it is virtually a cyclopedia of practical handicraft in wood.

HISTORY OF AMERICAN STEAM NAVIGATION. By John H. Morrison. New York: W. F. Sametz & Co. 1903. Ins. 8vo. Pp. 630 Price $4.

It is surprising that we should have passed into the twentieth century before any serious effort was made to write the history of American steam navigation; for although it is true that our present rank as a maritime nation is altogether incommensurate with our enormous industries and commercial interests, our contribution to the development of steam navigation has been a most generous one. The task of writing this history has been undertaken on a very complete scale; and the 630 pages of this book cover the subject so completely, that one feels satisfied on laying it down that there is no fact of any importance connected with the subject with which the book has not made him conversant. It opens with a chapter on the experimental stage, in which the early development of steamship navigation is traced, from the attempts of John Fitch, of Connecticut, to the establishment of the steamship on a practical business basis. Then follows a most fascinating chapter on navigation on the Hudson River. Cuts of the most famous "fliers" for the past fifty years are given, together with a description of the vessels and their best passages. It is surprising to learn that half a century ago a boat like the "Francis Skiddy" made the trip from New York to Hudson, 116¾ miles, at a speed per hour of 23.04 miles. In this connection, reference should be made to a chapter at the end of the book on high speed, in which the absurdity of many claims for high speed is shown. The author in testing these records looked up the logs of the various vessels, and by corrections for tides, etc., was able to show that the best passages of certain ships were many miles below the average speed with which they had been popularly credited. The book is divided into chapters on the development of navigation on western rivers and the various well-known lines on the Sound and elsewhere. Under the head of "Ocean Steamships" a fitting tribute is paid to the efforts of the United States to establish and maintain the famous Collins Line. The other chapters on coastwise steamship lines, steam ferry-boats, and the lighthouse and steamboat inspection service are of great value and interest.

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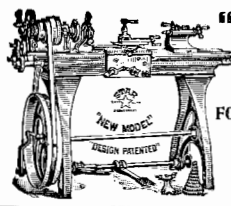

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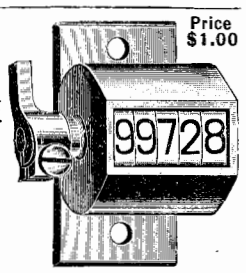

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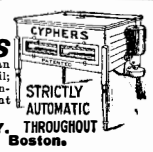

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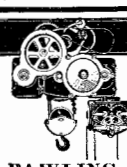

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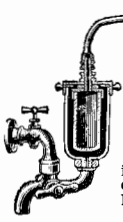

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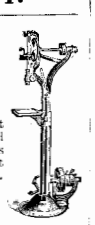

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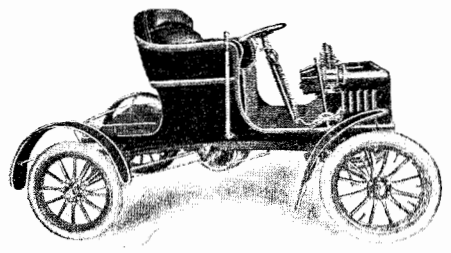

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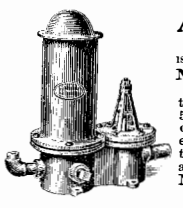

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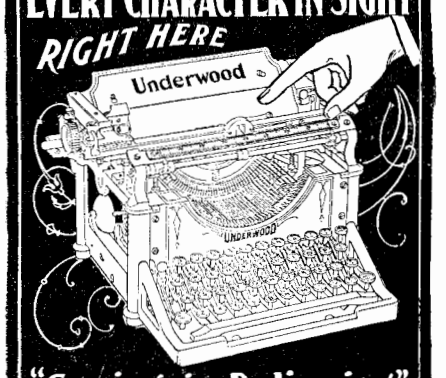

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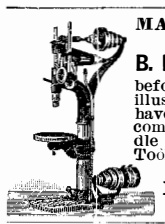

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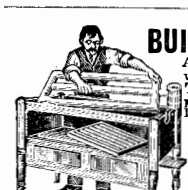

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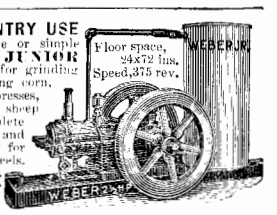

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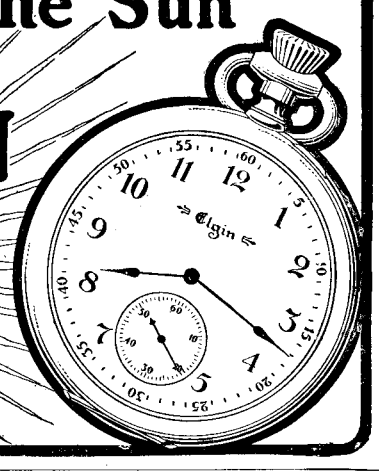

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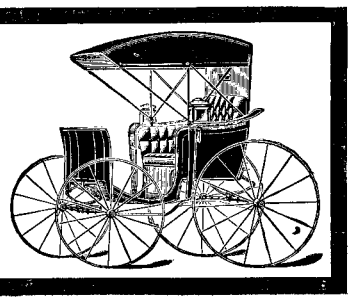

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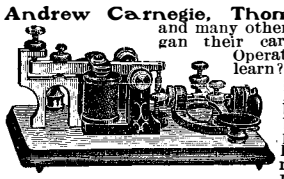

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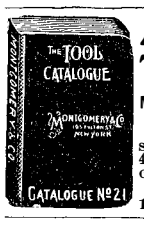

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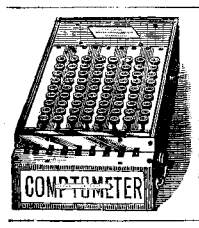

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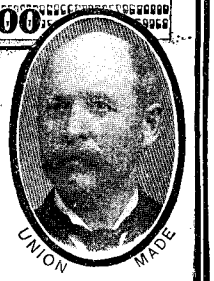

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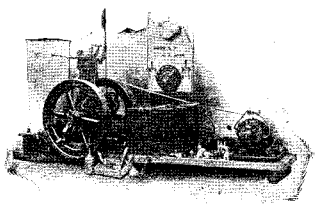

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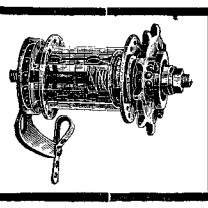

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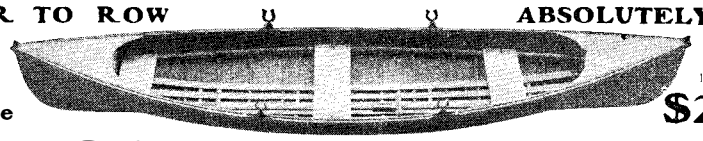

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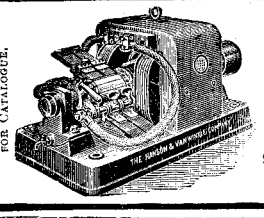

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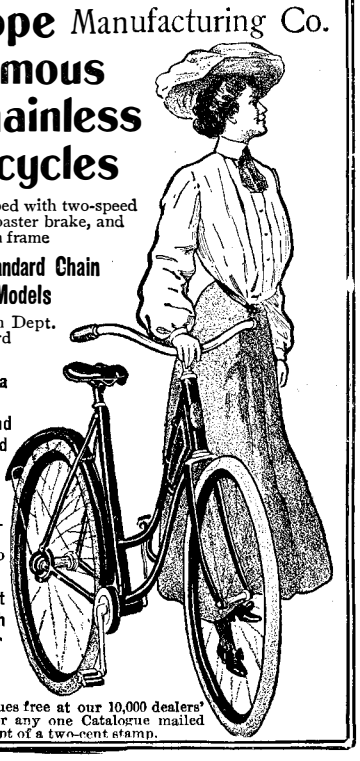

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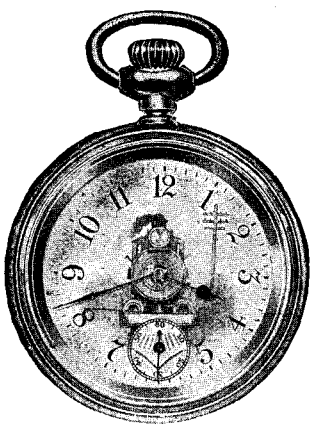

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